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2019 Technical Systems Audit Report

Shelby County Department of Health
Memphis, Tennessee

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1.0 Executive Summary

U.S. Environmental Protection Agency Region 4 Laboratory Services and Applied Science Division (EPA) personnel conducted a Technical Systems Audit (TSA) of the Shelby County Health Department, Pollution Control Section, Air Monitoring Branch (SCHD or Department) ambient air monitoring organization in August 2019. The purpose of the TSA was to evaluate the operation and performance of the SCHD air monitoring program, pursuant to 40 CFR Part 58, Appendix A, § 2.5. Data from the 2016-2018 calendar years were reviewed during the TSA.

SCHD currently operates five State or Local Air Monitoring Stations (SLAMS). During the TSA, four of the five SLAMS sites were evaluated for compliance to siting criteria pursuant to 40 CFR 58, Appendix E. All sites visited met the spacing requirements from trees and obstructions. Instrumentation appeared up to date and in good working order. Staff interviewed demonstrated technical understanding of the instrumentation used. Some fittings in the sample train that do not meet the material requirements stated in regulation must be replaced. Additionally, moisture was observed in some sample lines which can impact data quality. Measures should be implemented to control moisture in the sample train.

During the 2016-17 time period, SCHD performed in-house gravimetric analysis of hi-volume PM_{10} samples. Laboratory operations associated with this time period were evaluated during the TSA. Procedural nonconformances were observed and data were not handled in accordance with regulatory requirements. The hi-volume PM_{10} dataset will need to be revalidated with the identified non-conformances taken into consideration.

Inefficiencies and deficiencies were observed in the records management system that will need to be addressed to meet the records management requirements established in the Department's Quality Assurance Project Plan (QAPP). Forms will need to be revised to capture all the necessary information to properly validate the data generated. Staff also need to be trained on proper documentation techniques to ensure records are complete and defensible. A proper chain-of-custody form will need to be developed to document the possession of $PM_{2.5}$ filters throughout the lifecycle. Suggestions on ways to utilize network drives and electronic forms are included in this report that may help increase efficiency and security within the ambient monitoring program.

Data reporting and retention errors were also identified during the audit. For example, quality control checks were conducted but not submitted to EPA. Per regulation, these checks, if valid, are to be submitted. Supporting documentation reviewed did not justify these exclusions. $PM_{2.5}$ laboratory packages were not being reviewed and considered when validating filter-based methods which resulted in additional data reporting errors.

Findings and concerns identified in this TSA report indicate the need to focus more resources on the quality assurance aspects of the monitoring program. Quality documents were either absent during the period of interest, 2016-2018, or out of date. Documents and forms will need to be updated or developed as a corrective action from the TSA. The Department was recently granted approval of a criteria pollutant QAPP. The Department will need to review this document and ensure that all the quality assurance objectives set forth in the document are fully implemented. Specifically, the QAPP describes a multi-tiered validation process that must be implemented, and measures taken to ensure that each step is properly documented. To support these efforts, EPA recommends developing a data handling SOP that adequately instructs staff responsible for handling data their roles in the collection, validation, and reporting of ambient and supporting data.

Overall, SCHD is collecting accurate and precise ambient data as indicated by the bias and precision metrics. Technical knowledge of equipment used coupled with frequent independent performance evaluations prevented systemic data collecting errors from occuring. While the system in place has been effective, oversights impacting data quality did occur. Corrective actions will require the Department to assess the system in place and determine where improvements can be made to ensure complete and defensible data are collected. EPA acknowledges that the recommendations within the report will require additional resources. Several areas of potential resource savings were identified during the TSA (Concern 4.5.3) that could be reallocated towards quality assurance.

2.0 Introduction

On August 12 - 16, 2019, USEPA Region 4 personnel conducted a TSA of the SCHD ambient air monitoring program. The audit team included Keith Harris (lead auditor), Richard Guillot, and Stephanie McCarthy from EPA Region 4 Laboratory Services and Applied Science Division (LSASD). Sara Waterson from EPA Region 4 Air and Radiation Division was also in attendance.

The purpose of the audit was to assess SCHD's compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data. Pursuant to 40 CFR Part 58, Appendix A, § 2.5, TSAs of each Primary Quality Assurance Organization (PQAO) are required to be conducted every three years. Data reviewed as part of this TSA included that generated during the 2016-2018 calendar years. Data was queried from USEPA's Air Quality System (AQS) database prior to the on-site audit. EPA's Ambient Air Monitoring Technical Systems Audit Form was completed by SCHD staff prior to the on-site audit and is included as Appendix A of this report.

The audit included a review of data, recordkeeping, documentation, and support facilities housed at the SCHD office, located at 814 Jefferson Avenue, Memphis, TN. Four of the five regulatory air monitoring stations operated by SCHD were visited during the audit and the four stations are listed below.

Common Site Name	**AQS Identification**
Shelby Farms (NCore)	47-157-0075
STCC (Near-road)	47-157-0100
Alabama	47-157-0024
Frayser	47-157-0021

During the audit, the following SCHD personnel were interviewed.

- Kasia Smith-Alexander, Administrator
- Bob Rogers, Technical Manager
- Larry Smith, Assistant Manager
- Judy Low, Ambient Air Monitoring Branch Supervisor
- Yong Cai, Lead Technical Specialist
- Betty Brown, Technical Specialist
- Joe Maness, Technical Specialist

The following AQS reports were reviewed in preparation for this TSA.

- AMP 251: QA Raw Assessment Report (2016-2018)
- AMP 256: QA Data Quality Indicator Report (2016-2018)
- AMP 350: Raw Data Report (2016-2018)
- AMP 380: Site Description Report (2016-2018)
- AMP 390: Monitor Description Report (2016-2018)
- AMP 430: Data Completeness Report (2016-2018)
- AMP 450: Quick Look Criteria Report (2016-2018)
- AMP 480: Design Value Report (2018)
- AMP 501: Extract Raw Data (2016-2018)
- AMP 503: Extract Sample Blank Data (2016-2018)
- AMP 504: Extract QA Data (2016-2018)
- AMP 600: Certification Evaluation and Concurrence (2016-2018)

Additionally, the following SCHD documents were reviewed.

- *Quality Assurance Project Plan for the Shelby County Health Department for the Shelby County Health Department Ambient Air Monitoring. Revision number 0. January 31, 2019.*
- *Standard Operating Procedures for Ozone Transfer Standard Verification. Revision 1. December 30, 2015.*
- *Standard Operating Procedures for Ozone Monitoring on Teledyne API Models 400E and T400. Revision 1. December 30, 2015.*
- *Standard Operating Procedures for Mass Flow Controller Calibration/Verification (Teledyne API 700 Series Gas Dilution Calibrators). Revision 1. January 29, 2016.*
- *Standard Operating Procedures for CO Monitoring on Teledyne API Models 300E, 300EU and T300U. Revision 1. November 9, 2015.*
- *Standard Operating Procedures for SO_2 Monitoring on Teledyne API Model 100EU. Revision 1. October 6, 2015.*
- *Standard Operating Procedures for NO_2 NO_y Monitoring on Teledyne API T200U and 200EU.* (No revision number or date).
- *Standard Operating Procedures for $PM_{2.5}$ Monitoring on Rupprecht & Patashnick Sequential Air Samplers Model 2025. Revision 1. November 9, 2015.*
- *Standard Operating Procedures for Graseby-Andersen/GMW Model 321 PM_{10} High Volume Air Sampler. Revision 1. December 29, 2015.*
- *Standard Operating Procedures for Determination of Lead in Suspended Particulate Matter. Revision 1. March 5, 1987.*
- *Standard Operating Procedures for Particulate Matter Monitoring on R & P TEOM 1400a and Thermo Environmental 1405. Revision 1. January 26, 2016.*
- *Standard Operating Procedures for Measurement of Total Suspended Particulate. Revision 1. March 14, 1988.*
- *2016 Ambient Air Monitoring Plan. Shelby County Health Department Air Pollution Control Program Including the Metropolitan Statistical Area (Memphis, TN-MS-AR). April 2016.*
- *2017 Ambient Air Monitoring Plan. Shelby County Health Department Air Pollution Control Program Including the Metropolitan Statistical Area (Memphis, TN-MS-AR). April 20, 2017.*
- *2018 Ambient Air Monitoring Plan. Shelby County Health Department Air Pollution Control Program Including the Metropolitan Statistical Area (Memphis, TN-MS-AR). April 25, 2018.*

3.0 Commendations

The dedication and commitment of the current SCHD monitoring staff were evident during the TSA. Field staff interviewed demonstrated strong technical competency of the FRM/FEM

instruments utilized by the Department. The Department utilizes an independent contractor to conduct required annual performance evaluations (APE), providing an additional layer of independence when assessing the quality of data. The independent audit results and the collocated precision results exceed the agency's established objectives, indicating strong field operations. All standards certifications were easily accessed upon request, and no traceability issues were identified, which was an improvement since the 2013 TSA report. All sites visited during the TSA met the spatial requirements, from trees and obstructions, established in 40 CFR Part 58, Appendix E. Finally, the technical lead is in the process of developing a training program for new hires which will help improve data quality moving forward.

4.0 Findings and Recommendations

The observations from this TSA were compared to USEPA regulations, technical policies and guidance, and the SCHD quality system documentation.

Quality system deviations found through this TSA are classified into three categories: **Findings**, **Concerns**, and **Observations**. These quality system deviations are defined as follows:

Finding:	Nonconformance of high importance which is unacceptable and must be remedied. Includes departures from or absences of specified requirements (e.g., regulatory, QMP, QAPP, SOP, etc) or a guidance deviation which could significantly impact data quality.
Concern:	Nonconformance of somewhat lesser importance as compared to a finding, but one that should be remedied. Includes departures from widely accepted best science / management practices, as well as practices which could have potential detrimental effect on the ambient air monitoring program's operational effectiveness, quality system, or sampling/measurement results.
Observation:	An infrequent deviation, error, or omission which does not impact the output of the quality of the work product, but may impact the record for future reference.

For each of these categories, corrective action recommendations are provided. Corrective actions are required for all quality system deviations ranked as **Findings** or **Concerns**. Depending on the severity of the deviation, a specific data deliverable(s) may be requested to show that the corrective action recommendation has been successfully implemented. In these

cases, the TSA report will specify the deliverable(s) that will be required for AQS and/or submitted to EPA. **Observations** do not require corrective actions.

4.1 FIELD OPERATIONS

4.1.1 **Finding:** Unapproved fittings were observed in the sampling train of a gaseous pollutant analyzer.

Discussion: The Frayser (47-157-0021) air monitoring site did not meet the approved material requirements stated in 40 CFR Part 58, Appendix E. Pursuant to 40 CFR Part 58, Appendix E, § 9(a), for those analyzers which measure reactive gases only inert materials – borosilicate glass, Teflon, or their equivalent – are allowed in the sampling train (from the inlet probe to the back of the analyzer). During the inspection of SCHD's Frayser monitoring station, EPA auditors observed Kynar fittings in the sample train of the analyzer. These materials do not meet Appendix E specifications.

Recommendation: For the Frayser site utilizing Kynar components, the unapproved material must be replaced with Teflon (or its approved equivalent). Please provide evidence, in the form of a picture, as proof the Kynar fitting has been replaced. Furthermore, inspection of sample train components should be included as part of the annual siting evaluations and documented on the evaluation form, to demonstrate that this 40 CFR Part 58, Appendix E requirement is satisfied. Please submit a revised evaluation form with space to indicate that sample trains were inspected for unapproved materials.

4.1.2 **Concern:** Moisture was observed in the CO and NO_2 sample lines at the STCC site (47-157-0100).

Discussion: Visually identifiable water droplets condensated at multiple points on the walls of the sampling line inside the STCC shelter. Pipe insulation was installed as a preventative measure; however, additional measures may be required to prevent precipitation during high humidity events. Water can scrub pollutants, impacting ambient concentrations, QC checks, and calibrations, if present.

Sample lines need to be insulated from rapid changes in temperature, specifically during warmer months when warm humid air can quickly cool and precipitate as it enters the conditioned shelter. Lines should be moved away from air conditioning vents to reduce the rapid cooling. Given that insulation was present, heat tape may also be necessary to maintain sample temperature as it passes through the interior of the shelter and into the monitor. During data review, minute data needs to be reviewed to ensure data traces do not demonstrate patterns indicative of moisture in the sampling lines. EPA can assist in training to help identify patterns indicative of water in lines.

Recommendation: Please provide EPA with photographic evidence that inlet configurations have been modified to prevent accumulation of moisture. Additionally, please update SOPs with instruction on identifying moisture, along with how to handle equipment and impacted data when moisture is present. Submit updated SOPs to EPA for review.

4.2 LABORATORY OPERATIONS

SCHD utilizes Inter-Mountain Laboratories (IML) in Sheridan, Wyoming, for its $PM_{2.5}$ filter weighing activities (i.e, gravimetric analysis). Therefore, this TSA did not cover $PM_{2.5}$ weighing laboratory operations. However, SCHD is responsible for all $PM_{2.5}$ filter shipping and receiving activities, as well as the final validation of the resulting data. Due to time limitations, auditors briefly inspected the $PM_{2.5}$ filter shipping and receiving area and discussed these activities with staff. The shipping and receiving activities appeared to be in good order.

During the 2016-17 time period, SCHD performed in-house gravimetric analysis of hi-volume PM_{10} samples. Although SCHD transitioned to continuous PM_{10} and is not currently operating its filter weighing laboratory, because samples were weighed during the time period covered by this TSA, the previous laboratory operations were evaluated. The audit included a review of filter handing, weighing operations, and laboratory data management. Observations in the laboratory were compared to the PM_{10} gravimetric method requirements codified in 40 CFR Part 50, Appendix J, in addition to the requirements stated in the SCHD's Hi-Volume PM_{10} SOP and the recommendations in EPA's *Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere, High-Volume PM_{10} Sampler Method* (i.e., Method 2.11). Certification records for the laboratory standards and devices were reviewed to ensure: 1) the standards/devices utilized in the laboratory were traceable to a NIST standard of higher authority; and 2) the standards/devices were in continuous calibration/certification (i.e., not expired) throughout the time period under review. EPA notes the PM_{10} filter weighing activities were a shared responsibility amongst SCHD staff; no individual was identified as the primary laboratory analyst. The nonconformances that follow discuss the results of the PM_{10} laboratory audit.

4.2.1 **Finding:** Logbook records indicate temperature and relative humidity (RH) filter conditioning requirements were not met during some PM_{10} filter weighing sessions.

Discussion: 40 CFR Part 50, Appendix J, Section 7.4 states the specific temperature and RH conditioning requirements for PM_{10} sample filters. During the 24-hour conditioning period prior to the weigh session, the sample filters must be conditioned in a desiccation chamber which maintains a temperature range of 15-30° Celsius (± 3°C temperature

control) and a RH range of 20-45% RH (±5% RH control). If the filter conditioning specifications are not met, the filters must condition for another 24 hours in the prescribed range with adequate control. These requirements are also specified in the SCHD Graseby-Andersen/GMW Model 321 PM_{10} Hi-Volume Sampler.SOP (i.e., Hi-Volume PM_{10} SOP). A cursory review of PM_{10} logbook records identified weigh sessions that did not meet these requirements. For example, the 24-hour average RH documented in the laboratory logbook for the January 19, 2016 filter conditioning period was ~16.5%. Also, for the November 17, 2016 weigh session, logbook records indicated that both temperature or RH control requirements were not met during the filter conditioning period; the standard deviations documented in the logbook were 24.4°C and 26.9% RH, respectively.

Recommendation: SCHD must review its PM_{10} logbook records and invalidate samples weighed when filter conditioning regulatory requirements were not met. As deliverables for this finding, please provide EPA with a listing of the impacted samples by filter identification number, site name, and sample run date. Additionally, please provide AQS AMP 350 reports for the respective samples/sites in order to demonstrate data invalidation has occurred.

4.2.2 **Finding:** Traceability of laboratory standards / equipment was not maintained in accordance with SOP requirements.

Discussion: Two critical components of the PM_{10} gravimetric method are the analytical balance and the mass reference standards (i.e., weights). Section 2.3 of the SCHD Hi-Volume PM_{10} SOP specifies the analytical balance is calibrated at installation and twice per year by a vendor. However, certification records reviewed during the TSA showed annual calibrations were performed, as opposed to semi-annual. Section 1.4 of the same SOP specifies that the laboratory's weights are to be verified and calibrated by a vendor every 6 months. The SCHD maintains two sets of weight standards. Certification records reviewed demonstrated that the weights were certified every other year. Moreover, weight identification numbers were not recorded in the PM_{10} logbook to demonstrate which set of weights were used when performing routine filter weighing activities. Therefore, auditors could not confirm whether the weights used during the audit time period were NIST-traceable. Section 9 of EPA Method 2.11 states that traceability of standards and equipment is essential for attaining accurate PM_{10} data.

Recommendation: Because traceability of the laboratory weights could not be confirmed, and the balance and weights were not calibrated / certified in accordance with SCHD's quality system requirements, the PM_{10} sample 2016-2017 data set must be qualified with a "6" (QAPP issue) flag in AQS. As a deliverable for this finding, please

provide EPA with an AQS AMP 350 report to demonstrate the qualifier flag has been applied.

If PM_{10} gravimetric analysis resumes in the future, then the balance and weights must be recertified in accordance with the SCHD QAPP/SOP requirements, and documentation in the PM_{10} laboratory logbook enhanced to capture the identification numbers of the weight standards used during each weigh session.

Note: *EPA acknowledges that SCHD located the missing certification records for the analytical balance and submitted them to EPA for review after the TSA was completed. EPA will take this submission into consideration when tracking corrective action response.*

4.2.3 **Concern**: PM_{10} filter conditioning data summary calculations were not calculated properly and no independent validation was conducted to identify the mistakes.

Discussion: During the TSA, auditors compared the laboratory temperature / RH summary statistics recorded in the laboratory logbook to the files downloaded directly from the Fourtec temperature/RH datalogger, which is housed in the desiccation chamber. The datalogger was set to record hourly temperature and RH readings, so the staff member weighing filters would be required to calculate the 24-hour average and standard deviation statistics prior to each weigh session. Auditors' calculations, using the raw data, and the values observed in the logbook did not match. Instances were observed were the conditioning data recorded in the logbook did not represent the 24 hours preceding the weigh session, but represented 24-hour periods of previous days. Staff interviewed indicated instantaneous readings from the datalogger may also have been utilized in some instances, as opposed to 24-hour averages. Staff interviewed stated that independent data verification / validation was not performed.

Recommendation: EPA recommends that SCHD verify the accuracy of the 24-hour average and standard deviation temperature and humidity statistics recorded in the laboratory logbook. The Fourtec datalogger files should be used for this verification check. If the Fourtec datalogger files are not available, then the values recorded in the logbook remain "as found". EPA notes that the datalogger files for the November 17, 2016 weigh session identified in Finding 4.2.1 could not be located during the TSA. PM_{10} data reported to AQS for any weigh session where the filter conditioning requirements specified in 40 CFR Part 50, Appendix J were not met must be invalidated. As deliverables for this concern, please provide EPA with a discussion that summarizes the results of this verification process, including discrepancies identified, along with AQS AMP 350 reports for the impacted data.

4.2.4 **Observation:** The SCHD Hi-Volume PM_{10} SOP did not adequately address PM_{10} gravimetric operations. Laboratory records indicated the gravimetric method was implemented inconsistently.

Discussion: SCHD did not have a specific SOP for PM_{10} laboratory operations. However, some components of the gravimetric method – including traceability of the laboratory equipment and the filter preparation / conditioning requirements, were itemized in various sections of the SOP for the Graseby-Andersen/GMW Model 321 PM10 hi-volume field sampler. This field sampler SOP did not include the QA/QC requirements of the gravimetric method and the acceptance criteria, which are itemized in EPA Method 2.11. When reviewing the PM_{10} logbook, documentation of important QC activities, such as balance zero checks prior to each weigh session and zero/calibration rechecks during weigh sessions, were not consistently observed. The logbook documentation did not capture the sequence of the weigh session events, which would demonstrate that staff used consistent methodology. Concern 4.2.3 above also demonstrates inconsistencies in how the filter conditioning summary statistics were calculated.

Recommendation: Because SCHD no longer weighs PM_{10} filters, no corrective actions are required for this issue at this time. However, should SCHD decide to resume its gravimetric laboratory operations in the future, an SOP for the gravimetric laboratory would need to be developed that includes the methodology detailed in EPA Method 2.11. Additionally, the SCHD QAPP would also need to be amended, because it currently does not cover high-volume PM_{10} gravimetric operations. SCHD staff would also need to be trained on the PM_{10} laboratory requirements.

4.2.5 **Observation**: The laboratory datalogger was not certified annually.

Discussion: The Fourtec datalogger contains the temperature and RH sensors used to monitor environmental conditions of the PM_{10} desiccation chamber. Because the temperatures/RH readings are of critical value in the PM_{10} gravimetric method (see 40 CFR Part 50, Appendix J, Section 7.4), the datalogger should be NIST-traceable and certified annually, at a minimum. The Hi-Volume PM_{10} SOP states that a NIST-traceable digital hygrometer is used in the SCHD laboratory to record the temperature and RH readings in the desiccation chamber. However, the SOP does not stipulate the recertification frequency for the hygrometer. Records reviewed showed the Fourtec datalogger was certified/calibrated in November 2015 and then again in June 2017, which is a period of ~18 months.

Recommendation: If PM_{10} gravimetric analysis resumes in the future, then the Fourtec datalogger should be recertified on an annual basis. The SCHD QAPP/SOP would need to be revised to specify this certification frequency.

Note: *EPA acknowledges that SCHD located the missing certification records for the datalogger and submitted them to EPA for review after the TSA was completed.*

4.3 RECORDS MANAGEMENT

4.3.1 **Concern:** Forms used to document verifications and calibrations do not have sufficient information to fully verify and validate data.

Discussion: 40 CFR Part 58.16 requires that data be validated prior to entry into AQS. Section 22 of the 2019 QAPP provides general guidelines on SCHD's data validation process. Included in the process is a review of SCHD data against the individual pollutant measurement quality objectives (MQOs).

Some forms reviewed during the TSA lacked enough information to confirm Department MQOs were being met. For example, none of the forms reviewed contained acceptance criteria for the data being recorded. Ozone certification forms do not contain fields for "as found" instrument settings. Instrument adjustments and the magnitude, if made, need to be documented so that validators can determine if adjustments are significant enough to warrant data qualification.

Forms are a valuable tool that help standardize documentation, as well as simplify the data review process. As a best practice, forms should document all pertinent information to defend the data collected, clearly define the information to be recorded, and provide enough information so that end users do not have to rely on separate computation or information to interpret the content.

Recommendation: SCHD must conduct a review of the Department's verification and calibration forms to ensure all pertinent information is being captured to defend the data collected. As these forms are revised, please submit a copy to LSASD for review.

4.3.2 **Concern:** Information recorded on forms and in logbooks was incomplete and/or missing.

Discussion: Laboratory and site logbooks were reviewed during the TSA. Critical information needed to fully validate data against all MQOs was missing from some of the records reviewed. For example, the PM_{10} laboratory logbook did not contain acceptance criteria for filter conditioning requirements (Finding 4.2.1). Logbooks for the $PM_{2.5}$ samplers did not state when very sharp cut cyclones were cleaned, preventing validators

from determining if the separators were cleaned at the prescribed frequency established in the Department's QAPP.

Documentation techniques that do not meet the requirements of Section 9.2 of the QAPP were also observed. Spaces on forms, where information was expected, were left blank. Entries were scratched out instead of being properly stricken with a single line. Signatures were also absent from forms and logbook entries. Numerous Post-It Notes™ were found in the PM_{10} logbook containing laboratory temperature and RH summary statistics and weigh dates attached next to entries.

Recommendation: Standard operating procedures need to be updated to instruct users to properly document all activities required by the QAPP. Once updated, staff need to be trained on the revised SOPs, emphasizing proper documentation technique. Please submit SOPs to LSASD as they are revised. Additionally, provide documentation showing that training has been administered to staff.

4.3.3 Concern: Improvements are needed in electronic records management and storage.

Discussion: Section 6.5 of the 2019 SCHD QAPP states "The SCHD AMB will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision, and maintenance of documents and records." SCHD relies on electronic records at various stages of the data collection process. For example, data from calibration/verification of gaseous standards are originally recorded in an Excel spreadsheet, prior to being transferred to a written form. Logbooks are scanned monthly and stored electronically. Each of these records are stored either on personal workstations or personal work drives.

For these records to be properly incorporated into the quality system, they should be accessible to all staff tasked with generating or reviewing the records during data collection and validation. Shared network drives, with adequate user permissions to ensure that stored records and documents are properly secured, can be a useful tool to service this need.

Recommendation: SCHD should establish a shared drive where electronic records and documents can be stored and accessed by air monitoring staff. EPA recommends that the shared drive folders be configured such that all air monitoring staff have "read access" to the folders, as well as the ability to "add" files to the folders. However, "write" and "delete" access should be restricted to a designated administrator. If a mistake is identified within a saved file by the responsible staff member or reviewer, an appropriately labeled, corrected file should be saved in addition to the original file to

maintain transparency. Individual subfolders that are not write-protected can be created if needed for collaboration on document development or QAPP/SOP revisions. If utilized, such subfolders should be clearly labeled as "working folders", and the original, controlled versions of the documents should be in locked folder(s) found elsewhere on the LAN. Please notify EPA once a network drive meeting these requirements, or a reasonable alternative, is established.

4.3.4 **Concern:** Vulnerabilities were observed in SCHD's $PM_{2.5}$ chain-of-custody documentation.

Discussion: Chain-of-custody (COC) refers to the chronological documentation, or paper trail, showing the receipt, custody, control, transfer, analysis, and disposition of physical samples. SCHD currently uses a hardcopy form to document those who have maintained custody of each $PM_{2.5}$ sample throughout its life cycle. The form contains placeholders for 6 signatures of individuals responsible for various steps of the sample's life-cycle. The form also has placeholders for laboratory data, such as weigh dates and resulting masses, and comments from the site operators. However, upon review of the COCs, the majority of the placeholders on the form were left blank. Only 3 of the 6 signature lines were utilized. Times when the site operator collected the sample in the field, when the operator shipped the samples back to the contract laboratory, and when the laboratory received the shipment were documented. Missing were signatures documenting: 1) who from the laboratory relinquished the samples to SCHD and when; 2) who from SCHD received the sample shipment from the laboratory and when; and 3) who obtained samples from the shipment to prepare for sites and when. Currently, when a shipment of filters is initially received from the laboratory, the operators are responsible for selecting the filters they need from that shipment, and can do so at various times. No individual within the SCHD program has been designated as a sample custodian for the shipments.

Recommendation: To improve the defensibility of the $PM_{2.5}$ samples, COC documentation should reflect all individuals who have maintained possession of the sample during its life cycle. SCHD should develop and implement a revised COC process that captures all requisite signatures. When revising the COC, SCHD should remove the "Laboratory Information" and "Laboratory Comments" sections on the form that are not currently utilized. All sections of the revised COC should be consistently filled by staff and not left blank. Please provide EPA with a copy of the revised COC form once developed.

4.3.5 **Observation:** The efficiency of the current records management system could be improved.

Discussion: SCHD generates both digital and paper records (Concern 4.3.3). In some instances, electronic records are also printed and bound. In addition, calibration data is entered into a spreadsheet so that calculations can be computed by formulas included in the spreadsheet. These data are then transcribed to a paper form, which is retained as the official record. Electronic records may act as the original record if the information on the form is secure and cannot be edited once recorded. Electronic records also need to be backed up frequently to ensure that they can be retrieved if the primary storage fails or becomes corrupted. Time and effort could be saved by eliminating the hard copies of electronic records.

Recommendation: A review of the current records management system should be conducted to determine where resources can be saved by eliminating duplication or transcription. SCHD expressed an interest in moving towards more digital records. This review can help in that regard, as electronic forms can be implemented where possible. EPA will be glad to assist by helping to find example digital forms used by other agencies and reviewing the new forms developed by SCHD.

4.4 DATA MANAGEMENT

4.4.1 Finding: Not all quality assurance and quality control checks (QA/QC) were reported to AQS.

Discussion: 40 CFR 58.16 requires that "all ambient air quality data and associated quality assurance data" be reported to AQS. 40 CFR 58 Appendix A § 5.1.1 further clarifies reporting requirements by stating "the results of all valid measurement quality checks" are to be reported.

Nightly automated quality control (QC) checks of several monitors within the network were being conducted during the period of interest, 2016-2018. The checks were conducted in accordance to the regulatory requirements established in 40 CFR Part 58, Appendix A and therefore are considered "valid measurement quality checks"; however, these checks were not reported to AQS.

Recommendation: All valid checks must be reported to AQS in accordance with 40 CFR 58.16. All valid checks (QC checks, performance audits, flow rate checks, and flow rate audits) starting in 2019 and moving forward are to be reported to AQS. Please provide EPA with an AMP 251 showing checks have been uploaded to AQS.

4.4.2 Finding: Filter-based $PM_{2.5}$ data has not been fully validated.

Discussion: 40 CFR 58.16(c) requires that data entered into AQS be validated. In order to validate filter-based $PM_{2.5}$ data, results from the gravimetric analysis must be evaluated, in addition to data from the field sampling event. Currently, SCHD outsources the gravimetric analysis of its $PM_{2.5}$ samples to IML in Sheridan, WY. IML provides monthly and quarterly data packages to SCHD with the results of sample analyses summarized. Additionally, IML provides an AQS-ready file containing sample concentrations that can be immediately uploaded to AQS, provided that SCHD agrees that no additional AQS codes or flags are needed based upon their final review and validation of the $PM_{2.5}$ data package. Towards that end, the laboratory data packages contain the following statement:

> *"Inter-Mountain Laboratory's (IML) data validation is limited by the provided information. Data have been validated based on laboratory QC, field observations, and other information available to IML. Additional data validation based on information not provided to IML may be required. According to 40 CFR 58.15 final responsibilities for data review and validation lies with each agency submitting data to AQS."*

During the TSA, IML data packages and AQS-ready files were requested for two $PM_{2.5}$ samples. Upon review, inconsistencies were observed in how the data was reported by the laboratory. For the June 7, 2018 Shelby Farms collocated $PM_{2.5}$ sample (47-157-0075-2), the sample contained an "XT" laboratory flag within the data package, but the AQS-ready file reported a valid concentration with an AQS "1" (i.e., Deviation from a CFR Critical Criteria Requirement) qualifier flag added. At the Guthrie site (47-157-0047-1) in November 2016, the XT flag was applied to five consecutive samples (November 17 – 29) in the laboratory data package, but no "1" flags were added to the AQS data file. IML's in-house "XT" flag means "Sample period followed tare analysis by more than 30 days"; it is applied by IML's data management system when a site operator uses an expired filter. 40 CFR Part 50, Appendix L, Section 8.3.5 specifies that filters must be used within 30 days of their initial tare. With this in mind, all of these samples should have been invalidated by SCHD upon review of the laboratory data packages.

When discussing this issue, staff indicated that a comprehensive review of IML data packages does not routinely occur, in part because it was expected that the laboratory would have performed that function. Instead, SCHD staff perform a cursory review. However, there was no SOP available that detailed the $PM_{2.5}$ data review process to ensure consistency.

Recommendation: Going forward, SCHD staff must perform a review of the $PM_{2.5}$ data packages provided by IML to ensure the $PM_{2.5}$ data meets regulatory requirements and

the requirements of SCHD's QAPP. Towards that end, SCHD must develop a data handling SOP that includes review of the $PM_{2.5}$ laboratory data. Once completed, please provide the SOP to EPA, along with documentation that demonstrates staff have been trained.
Additionally, EPA recommends the samples, taken using expired filter media, identified in this finding be invalidated in the AQS database. Please provide EPA with AMP 350 reports for these two sites as deliverables for this corrective action.

4.4.3 **Concern:** Data are not being fully validated to ensure all measurement qualtiy objectives are satisfied.

Discussion: 40 CFR 58.16(c) requires that all ambient air quality data and associated quality assurance data be validated prior to reporting to AQS. Data points across all pollutants were investigated during the TSA, to ensure that data were properly validated, and the correct data validity or qualification decisions were applied. Examples of lapses in the data validation process are summarized below.

- Hi-Volume PM_{10} data were not being validated against critical laboratory MQOs (Finding 4.2.3).
- $PM_{2.5}$ laboratory packages were not reviewed (Finding 4.4.2)
- A 7% shift in consecutive QC check results was observed in the Frayser ozone dataset during the summer of 2018. According to logbook entries, the operator repeatedly observed moisture in the sample line during this period. Logbooks were not reviewed during validation; therefore, the persistent moisture problems were not taken into consideration when validating the impacted data.

Section 21 of the Department QAPP states that data are validated against the pollutant MQOs. Section 23 of the SCHD QAPP describes a tiered approach to data validation. The level one review requires the operator to verify and code their work. The level two review requires an independent reviewer confirm that the level one work is complete, as well as review all logbooks and forms to ensure data meet the MQOs. EPA acknowledges that the SCHD QAPP was not in place during the TSA period of interest; however, above are examples of data entry errors that should be caught if the process in the QAPP is implemented. Staff stated that they are currently not fully implementing the approved QAPP. The Department's QAPP is considered an extension of regulation and the policies and procedures described within must be followed.

Recommendation: EPA recommends that staff be trained on the validation procedures described in the Department's approved QAPP. Please provide EPA with evidence once staff have been properly trained on their responsibilities as described in Section 23.

Additionally, EPA recommends incorporating these data handling responsibilities, with greater detail, into a data handling SOP (Finding 4.5.2).

4.5 QUALITY ASSURANCE

4.5.1 **Finding:** Criteria pollutant data were collected at SLAMS monitoring stations and reported to AQS without a current, approved QAPP.

Discussion: Monitors collecting data for regulatory decision-making purposes must operate with a current, approved QAPP in place, pursuant to 40 CFR Part 58, Appendix A, § 2.1.2. The regulation further states that QAPPs must be suitably documented in accordance with EPA requirements; the regulation references EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5) (EPA/240/B-01/003; March 2001) for such requirements. It is stated in Section 2.7 of the EPA QA/R-5 document that QAPPs developed for multi-year monitoring programs must be revised and resubmitted for review and approval whenever revisions to the document are necessary. Beginning with fiscal year (FY) 2015, EPA Region 4 grant commitments/reporting requirements have either indicated or directly stated that QAPP approvals expire every five years.

SCHD elected to become a sole primary quality assurance organization (PQAO), independent of the State of Tennessee, starting in calendar year 2015. The Department was given one year to develop a QAPP that would cover the environment data operation (EDO). A draft was submitted to EPA on July 24, 2017. The submitted QAPP required multiple revisions and was not approved until February 1, 2019; therefore, SCHD was operating without an approved QAPP starting 2016 until the approval date.

Recommendation: Since the Department was not operating under an approved QAPP during the TSA period, the Department must apply "6" (i.e., QAPP Issue) qualifier flags to its entire criteria pollutant dataset in AQS from January 1, 2016, through February 1, 2019, to alert end data users of the quality system deviation. Please provide EPA with an AQS AMP 350 report once the concentration data have been qualified in AQS.

Going forward, the QAPP and its associated SOPs should be reviewed on an annual basis, with the reviews documented to attest to their completion. The QAPP must be revised whenever significant changes to federal regulation, Department procedures, or other requirements or guidance occur. Minimally, the QAPP must be revised within five years of its approval date.

4.5.2 **Finding:** Standard operating procedures are out of date and do not reflect current practices. A data handling SOP has not been developed.

Discussion: 40 CFR 58 Appendix A § 2.1.2 requires that PQAOs develop a QAPP and include SOPs for all EDOs discussed within the document. Many of the SOPs reviewed in preparation for this TSA were last revised prior to early 2016. Regulations and guidance have changed since those last revisions. Also, the Department has since developed a QAPP. The SOPs reviewed did not fully support the objectives of the approved QAPP, nor accurately reflect procedures being performed by the Department.

Additionally, the SCHD QAPP discusses data verification and validation and provides a framework for handling data generated by the Department; however, the QAPP does not describe the verification, validation, and reduction techniques in enough detail. The QAPP also does not discuss how data will be consistently coded and qualified. Each of these steps need to be clearly defined so that staff consistently handle data.

Recommendation: Department SOPs must be reviewed and revised to ensure that they accurately reflect the procedures implemented by Department staff. The recently approved QAPP contains MQOs for each pollutant. SOPs must be updated to ensure that these MQOs are achieved.

SCHD must also develop a data handling SOP that includes review of all information associated to collected data, including logbooks, forms, and $PM_{2.5}$ laboratory data and instructions on how to consistently handle data based on the information available.

Please submit a revision/development schedule with expected completion dates. Finally, submit revised SOPs in accordance with the schedule as evidence, once they are finalized and approved by the Department.

4.5.3 **Concern:** Additional resources are needed for the qualtiy assurance component of the Department's monitoring program.

Discussion: Pursuant to 40 CFR Part 58, Appendix A, Section 2.2, the monitoring organization must provide for a quality assurance management function, which must have technical expertise to conduct independent oversight of the Division's air monitoring program. Specifically, this Appendix A requirement states:

> *The quality assurance management function must have sufficient technical expertise and management authority to conduct independent oversight and assure the implementation of the organization's quality system relative to the ambient air quality monitoring program and should be organizationally independent of environmental data generation activities.*

In addition, 40 CFR Part 58, Appendix A, Section 2.1.3 states, "The monitoring organization's quality system **must** have adequate resources both in personnel and funding to plan, implement, assess and report on the achievement of the requirements of [Appendix A] and its approved QAPP" [emphasis added].

SCHD does not currently have a Quality Assurance Manager (QAM) tasked solely with performing QA activities. Several findings and concerns identified in this report indicate a need for this role. QAMs are typically responsible for managing quality documents (Finding 4.5.1, 4.5.2, and Observation 4.5.4) as well as records (Concern 4.3.1, 4.3.3, 4.3.4, and Observation 4.3.5). QAMs also play an important role in the data validation process (Finding 4.4.2 and Concern 4.4.3).

Limited resources were frequently cited as the reason the Department could not properly implement a quality assurance system. EPA acknowledges that resources are limited within the Department. During the TSA, areas were identified where both time and financial commitments could be saved and reallocated towards quality assurance. Below is a summary of the potential resource savings identified during the TSA:

- $PM_{2.5}$ field blanks are being collected at a greater frequency than required. The additional data are not being analyzed for a specific purpose; therefore, the additional cost to analyze these filters is unnecessary.
- The Department hires a contractor to conduct quarterly APEs. Only one is required per year, per regulation. SCHD currently owns the necessary equipment to conduct these audits. If the Department would like to maintain the quarterly frequency, as well as the security of an independent assessment by a contractor, three audits can be conducted in-house, and the fourth could be conducted by an independent contractor.
- Mass flow controller and photometer certifications are currently being conducted at a greater frequency than guidance suggests. These certifications are also performed in duplicate. While these additional certifications add confidence in the accuracy and precision of the data collected, these efforts are time consuming. SCHD should review the data from these more frequent verifications and duplicate analyses to determine if they are warranted. If not, these resources could be reallocated to qualtiy assurance, where individuals can independently review the work performed to ensure it meets all the quality standards.
- Redundancy in record keeping practices (Concern 4.3.3).
- Manual QC checks are being conducted weekly at sites when each is configured to conduct automated checks. Travel time to sites, as well as work time at sites, could be reduced and reallocated towards improved data verification/validation and site maintenance.

- Several expired compressed gas cylinders were observed in the network. These additional tanks occupy space and cost the Department monthly demurrage.
- The microbalance used to weigh PM_{10} filters was being certified despite laboratory operations having been discontinued.

The potential time and financial savings identified above could be reallocated towards quality document development and maintenance, form development, data review, and asset repair or replacement, ensuring the data produced are properly quality assured.

Recommendation: SCHD should review its operations, taking into consideration the list of resource savings proposed above, and determine where efficiencies can be gained in the monitoring program. Please provide EPA with a discussion of how the Department will increase QA oversight throughout its air monitoring program.

5.0 Conclusions

The 2013 TSA report identified lapses in the traceability of the gaseous pollutant standards. As a result, SCHD developed a rigorous verification program. In doing so, staff developed a strong technical understanding of the instrumentation, a testament to their dedication. While this process helped ensure the precision and bias estimates met the data quality objectives, data processing errors occurred that impacted the data quality of specific time periods (i.e., days or weeks). The additional verifications being performed consumed resources; therefore, these data were not properly reviewed and validated. Improvements to the data handling process could improve the efficiency and effectiveness of the quality system and eliminate the need for the additional verifications. Developing and implementing sound procedures coupled with a thorough data validation process will ensure that accurate and defensible data are produced. Updating procedures and forms will also ensure that data are handled consistently, and data decisions are correct, unbiased, and objectively based on a comprehensive weight of evidence approach.

SCHD staff demonstrated a desire to improve the program. The technical lead was in the process of developing a training program for new hires. The Department also expressed interest in digitizing forms and moving towards a digital records management system. EPA can assist in these efforts if requested, for example providing forms and documents that other agencies have made available to share.

Finally, the Department recently received approval for the criteria pollutant QAPP. The QAPP is a contract between the Department and EPA that describes how data are collected, reviewed, and reported. Therefore, all the elements within the QAPP must be implemented as written, unless they contradict current regulatory requirements. If the Department cannot fully implement all

elements in the QAPP, the document should be revised to reflect current practices and submitted for approval.

SCHD must develop a corrective action plan and timeline to address the findings and concerns identified in Section 4 of this report and respond back to EPA within 30 days of receipt of the final TSA report. Please note that the corrective actions do not have to be completed by this date, only a plan to address the findings and concerns. Observations do not require a corrective action, therefore, do not need to be addressed. If SCHD anticipates that the development of the corrective action plan will not be completed within 30 days after the receipt of the final TSA report, please contact EPA to request an extension.

Appendix A

SCHD Response-Technical Systems Audit Form

APPENDIX A

United States

Environmental Protection Agency

Region 4

Science & Ecosystem Support Division

980 College Station Road

Athens, Georgia 30605

Ambient Air Monitoring

Technical Systems Audit Form

Contents

1. General

Note: As you answer the questions throughout this questionnaire, please keep in mind that answers to some questions may be documented in your agency's QMP, QAPP(s), SOP(s), and/or annual monitoring network plan. As an alternative to providing language in the comment field for such questions, please consider listing an appropriate reference to the document(s) – including document name and section number – in which the relevant information has been documented. Such references should help reduce the burden of completing this questionnaire through mitigating redundancy.

Shelby County Health Department, Pollution Control Section/Air Monitoring Branch

Address:

814 Jefferson Ave., Room 438R

Memphis TN 38105

Date(s) of Technical Systems Audit: 8/16/2019

This section of the questionnaire completed by: Yong Cai/Judy Low

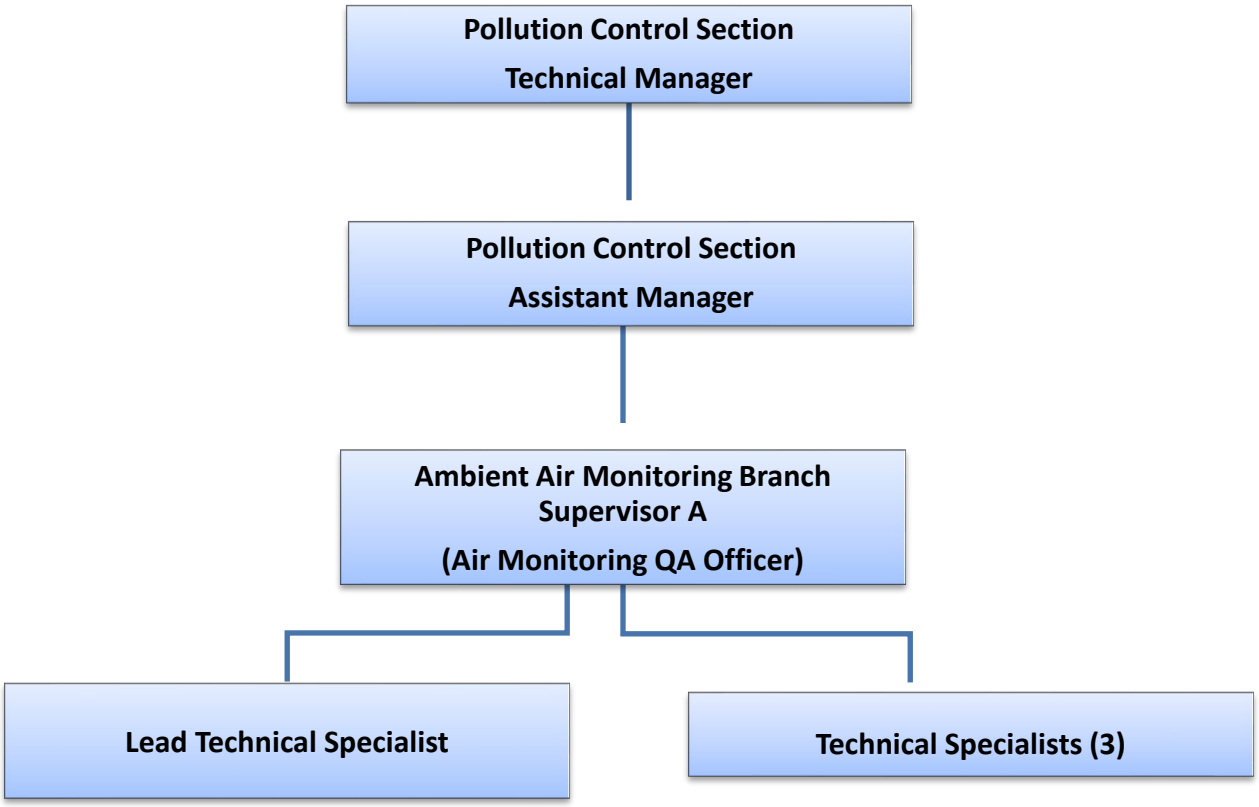
Key Individuals (e.g., Agency Director, Ambient Air Monitoring Network Manager, QA Manager, Technical Support/Instrument Repair Manager, etc.):

Title/Position	Name
Technical Manager	Bob Rogers
Assistant Manager	Larry Smith
Supervisor	Judy Low
Lead Technical Specialist	Yong Cai

a. Program Organization

a.1 Organizational Chart

Upload an organizational chart, or attach to the form:



a.2 Key Position Staffing

Enter the number of personnel available to each of the following program areas, and any vacancies, if applicable.

Program Area	Number of People (Primary)	Number of People (Backup)	Number of Vacancies
Network Management (site setup, siting, ANP, etc.)	1	1	0
Field Operations (QC checks, site visits, site maintenance, etc.)	3	1	1
Quality Management (audits, QA documentation, certifications, etc.)	4	0	1
Data and Data Management (data review, validation and acquisition system, AQS, etc.)	1	1	0
Technical Support (equipment repair and maintenance)	3	1	1
Internal Analytical Laboratory (if applicable) ($PM_{2.5}$ gravimetric, high-volume PM_{10}/Pb, toxics, etc.)	N/A	Click or tap here to enter text.	Click or tap here to enter text.

Comment on the need for additional personnel, if applicable.

We need one personnel for data quality assurance and data management. Internal analytical laboratory was used only through the end of 2016 at which time the high volume PM_{10} filter base sampling discontinued.

b. Facilities

*Identify the principal facilities where the agency conducts work related to air monitoring. **Do not include monitoring stations**, but do include facilities where work is performed by contractors or other organizations.*

Ambient Air Monitoring Function	Facility Location	Comment on any significant changes to be implemented within the next one to two years.
Instrument repair	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
Certification of Standards (e.g., gases, flow transfers, MFCs)	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
PM filter weighing	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
Pb analysis	N/A	N/A
Data verification and processing	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
General office space	814 Jefferson Ave. Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
General lab/work space	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Memphis, TN within next two years
Storage space (short and long term)	814 Jefferson Ave., Room 438R Memphis TN	Plan to move to 1826 Sycamore View Road, Cordova TN within next two years
Air Toxics (Carbonyls, VOCs, PAHs, Metals)	N/A	N/A

Indicate below any facilities that should be upgraded or any needs for additional physical space (laboratory, office, storage, monitoring stations, etc.).

Edmund Orgill and NCore Shelters need to be replaced. Need a storage room. Lab needs to be modified for certification.

c. General Documentation Policies

Complete the following table. If relevant information is provided in a QMP, QAPP, and/or SOP, please provide an appropriate reference in the comment field in place of descriptive language.

Question	Yes	No	Comment
Does the agency have a documented records' management plan?	☒	☐	**Work in progress**
• If yes, does this include electronic records?	☒	☐	**Work in progress**
Does the agency have a list of files considered official records and their media type (i.e., paper and/or electronic)?	☒	☐	Click or tap here to enter text.
Does the agency have a schedule for retention and disposition of records? Are records kept for at least three years? Comment on how long records are retained.	☒	☐	**See Section 9.6 of QAPP**
Who is responsible for the storage and retrieval of records? If more than one person, please indicate those personnel responsible for storing/retrieving records, including what records each is responsible for.			Judy Low
What security measures are utilized to protect records?			**We store records in both electronic and paper formats in lab.**
Where/when does the agency rely on electronic files as primary records?			**There would always be electronic and paper copies of documentation**
What is the system for storage, retrieval and backup of these files?			**See Section 9.6 of QAPP**

d. Training

d.1 Training Plan

Complete the following table.

Question	Yes	No	Comment
Does the agency have a training plan? If yes, where is it documented?	☒	☐	Click or tap here to enter text.
If yes, does the training plan include:			
• Training requirements by position?	☒	☐	Click or tap here to enter text.
• Frequency of training?	☒	☐	As needed
• Training for contract personnel?	☐	☒	Click or tap here to enter text.
• A list of core QA-related courses? Please attach a list of required courses or cite where such information may be found.	☒	☐	EPA QA Handbooks, TAD, Operator Manuals, QAPP, SOPs, EPA AMTIC
• Does it make use of seminars, courses, EPA-sponsored college level courses, etc.?	☒	☐	When available
Are personnel cross-trained for other ambient air monitoring duties?	☒	☐	Click or tap here to enter text.
Are training funds specifically designated in the annual budget?	☒	☐	Where applicable

d.2 Training Events

Indicate below the most recent training events, and identify the personnel who participated in them.

Event	Date(s)	Participant(s)
Training for Maurice Stallworth and Betty Brown	12/30/2018	Betty Brown, Maurice Stallworth, Joe Maness, Yong Cai, Judy Low
QA Training in Athens, GA	10/3/17 thru 10/5/17	Judy Low

e. Oversight of Contractors and Supplies

e.1 Contractors

Complete the following table. If your agency does not use contract personnel, proceed to section e.2 Supplies.

Contractors	Yes	No	Comment
Who is responsible for oversight of contract personnel?			**Air Monitoring Supervisor**
Are contractors providing a service (e.g., independent performance audits, $PM_{2.5}$ lab) audited? How often?	☒	☐	**Independent performance audits by EEMS quarterly; PM filters are shipped to IML every two weeks for analysis**
What steps are taken to ensure contract personnel meet training and experience criteria?			**Instrument certificates, personnel certification for audit**
Are contractor Quality Documents reviewed before procuring a service?	☒	☐	Click or tap here to enter text.
How often are contracts reviewed and/or renewed?			**Annually**

e.2 Supplies

Complete the following table. If relevant information is provided in a QMP, QAPP, and/or SOP, please provide an appropriate reference in the comment field in place of descriptive language.

Suppliers	Yes	No	Comment
Have specifications been established for consumable supplies and/or equipment?	☒	☐	**See Section 17 of QAPP**
What supplies and equipment have established specifications?			All monitoring/certifying instruments, tubing and standard gases
Is equipment from suppliers open for bid?	☒	☐	If items are over 5,000.00 unless the vendor is a sole source

2. Quality Management

This section of the questionnaire completed by: Yong Cai / Judy Low

Key Individual(s):

Title/Position	Name
Supervisor	Judy Low
Lead Technical Specialist	Yong Cai
Technical Specialist	Joe Maness
Technical Specialist	Betty Brown

a. Status of QA Program

a.1 QA and QC Activities

Complete the following table.

Question	Yes	No	Comment
Does the agency perform *all* quality assurance (QA) activities with internal personnel (i.e., developing QMPs/QAPPs/SOPs and DQOs/MQOs, performing systems audits, assessments and performance evaluations, corrective actions, validating data, QA reporting, etc.)? If not, please indicate in the comment field who is responsible and which QA activities are performed.	☒	☐	EEMS performs quarterly QA audits of the particulate matter and gaseous analyzers. TDEC performs biannual audits of the program.
If the agency has contracts or similar agreements in place with either another agency or contractor to perform audits or calibrations, please name the organization and briefly describe the type of agreement.			Tennessee Department of Environment and Conversation for biannual audits and Environmental Engineering & Measurement Services for quarterly audits
Does the agency perform *all* quality control (QC) activities with internal personnel (i.e., zero/span/one-point QC checks, calibrations, flowrate, temperature, pressure and humidity checks, certifying/recertifying standards, lab and field blanks, data collection, balance checks, leak checks, etc.)? If not, please indicate in the comment field who is responsible and which QC activities are performed.	☒	☐	Click or tap here to enter text.

a.2 QC Acceptance Criteria

Complete the following tables.

Question	Yes/No	Location	Comment
Has the agency established and documented criteria to define agency-acceptable QC results?	Yes	814 Jefferson Ave., Memphis 38105	Click or tap here to enter text.

Pollutant	Does the agency adhere to the critical QC acceptance criteria for criteria pollutants[1] and meteorological measurements[2]?	QC Acceptance Criteria (if other than validation templates)	Action or Warning Limits	Corrective Action
SO2	Yes	≤±10%	≤±10%	Multi-point check and Calibrate if over the acceptance criteria
O3	Yes	≤±7%	≤±7%	Multi-point check and Calibrate if over the acceptance criteria
PM2.5/PM10	Yes	±4.0% of Transfer Standard	±4.0%	Multi-point check and Calibrate if over the acceptance criteria
CO	Yes	≤±10%	≤±10%	Multi-point check and Calibrate if over the acceptance criteria
NO/NO2/NOx	Yes	≤±15%	≤±15%	Multi-point check and Calibrate if over the acceptance criteria

[1] Appendix D Validation Templates of the *QA Handbook for Air Pollution Measurement Systems Volume II*
[2] Appendix C Validation Templates of the *QA Handbook for Air Pollution Measurement Systems Volume IV*

b. Internal PE Audits

b.1 Internal Audit Questions

Complete the following table.

Question	Yes	No	Response
Does the agency maintain a laboratory to support QA activities?	☒	☐	**Laboratory was utilized when high volume PM 10 filters needed to be weighed**
Has the agency documented and implemented specific audit SOPs separate from monitoring SOPs?	☐	☒	Click or tap here to enter text.
Are the QA personnel organizationally independent from the personnel responsible for generating environmental data (40 CFR Part 58, Appendix A, § 2.2)? If no, please explain in the comment field.	☐	☒	Click or tap here to enter text.
Are annual performance evaluation (PE) audits conducted by technician(s) other than the routine site operator(s) (40 CFR Part 58, Appendix A, § 3.1.2)? If no, please explain in the comment field.	☒	☐	**By EEMS or TDEC**
Does the agency have identifiable auditing equipment and standards (specifically intended for sole use) for audits?	☒	☐	**When necessary**
Are audit equipment and standards ever used to support routine calibration and QC checks required for monitoring network operations? If yes, please explain in the comment field.	☐	☒	**Multiple devices are available for sit e operators to use to perform flow verifications and another one is used for calibrations**

b.2 Internal Audit Procedures

If the agency includes performance audit procedures in pollutant-specific monitoring SOPs, please provide an appropriate reference for each pollutant. Otherwise, if the agency does not have a performance audit SOP, please describe the performance audit procedure for each type of pollutant.

Pollutant	SOP/Performance Audit Procedure
Choose an item.	Click or tap here to enter text.

No internal audits are performed unless contractor has an issue with their equipment. A separate set of instruments and devices are used for internal audits, if necessary.

b.3 Certification of Audit Standards

Attach a list or use the table below to provide information on the certification(s) of audit standards (e.g., flowmeters, gas standards, etc.) currently being used.

Vendor	Audit Standard	Certification	Certification Frequency	Date of Last Certification
Airgas/Scott	Click or tap here to enter text.	Choose an item.	According to vendor	Click or tap here to enter text.

See Section 16 of QAPP

Complete the following table.

Question	Yes	No	Comment
Does the agency have a separate certified source of zero air for performance audits?	☒	☐	Click or tap here to enter text.
Does the agency have procedures for auditing and/or validating performance of meteorological monitoring?	☒	☐	Click or tap here to enter text.

b.4 Audit Equipment

Use the table provided below to list the agency's audit equipment and age of audit equipment (e.g., flow standards, calibrators, zero air systems, etc.).

Manufacturer	Make and Model Number	Purchase Year or Year Acquired
Teledyne Advanced Pollution Instrumentation	T750H	2015
Teledyne Advanced Pollution Instrumentation	751H	2015
Mesa Labs	Tetra Cal	2014
Mesa Labs	200-220L Definer 220 (Low Flows)	2014
Mesa Labs	200-220H Definer 220 (High Flow)	2014

b.5 Audit Acceptance Criteria

Complete the following tables.

Question	Yes/No	Location	Comment
Has the agency established and documented criteria to define agency acceptable audit results? If yes, comment where (page number, section, etc.)	Choose an item.	Choose an item.	Click or tap here to enter text.

See Section 7 validation templates in QAPP

Pollutant	Does the agency adhere to the audit acceptance criteria for criteria pollutants[3] and meteorological measurements[4]?	PE Audit Acceptance Criteria (if other than validation templates)	Do the audit levels (gaseous PE audits only) meet 40 CFR Part 58, Appendix A, § 3.1.2.1 criteria?	Corrective Action
Choose an item.	Choose an item.	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.

c. Planning Documents Including QMP, QAPP, & SOP

c.1 QMP Questions

Complete the following table.

Question	Response
Does the agency have an EPA-approved quality management plan (QMP)?	Yes
• If yes, what is the approval date of the QMP?	7/1/2018
• If yes, has the QMP been approved by EPA within the last 5 years?	Yes
• If yes, is the QMP multi-media or air-specific?	Multi-media
• If yes, are changes to the plan needed that have not yet been approved by EPA?	No

[3] Appendix D Validation Templates of the *QA Handbook for Air Pollution Measurement Systems Volume II*

[4] Appendix C Validation Templates of the *QA Handbook for Air Pollution Measurement Systems Volume IV*

c.2 QAPP Questions

Complete the following table.

Question	Response
Does the agency have an EPA-approved QA project plan (QAPP)?	Yes
• If no, has the agency been delegated self-approval?	Choose an item.
How often does the air monitoring agency review QAPPs? Are these reviews documented? If so, please provide a location.	Annually
Does the agency have any QAPP revisions still pending EPA approval?	No
How does the agency verify that the QAPP is fully implemented?	Regular check forms
How are staff notified and trained when a QAPP is revised?	Staff are notified by email and trained in our branch meeting
What personnel regularly receive updates?	Site operators
Does the agency have any missing QAPPs that need to be developed?	No
• If yes, list any missing QAPPs.	Click or tap here to enter text.

Provide a list of all QAPPs as an attachment or use the table below. If provided elsewhere, please provide a reference.

QAPP Title	Approval Date	Pollutant(s)	Status
Quality Assurance Project Plan for the Shelby County Health Department Ambient Air Monitoring Program	2/1/2019	all	Approved

c.3 SOP Questions

Complete the following tables.

Question	Response
Are all standard operating procedures (SOPs) complete, or are some in development?	in development
Does the agency have any missing SOPs that need to be developed?	Work in progress for O3, NO, CO, SO2, PM 2.5
• If yes, list the SOPs that need to be developed.	
Are SOPs available to all field operations personnel?	Yes
Are SOPs for "episodic monitoring" prepared and available to field personnel? Refer to *QA Handbook Volume II, Section 6.0*.	No
Are SOPs based on the framework contained in *Guidance for Preparing Standard Operating Procedures (SOPs) (EPA QA/G-6)*?	Yes
Does the agency have SOPs specific to data handling and validation?	Work in progress
Who approves SOPs?	EPA Region 4
How often are SOPs reviewed? Are these reviews documented? If so, please provide a location. How often are SOPs updated?	Annually
How are staff notified and trained when a SOP is revised?	Staff are notified by email and trained in our branch

Provide a list of all SOPs as an attachment or use the table below. If provided elsewhere, please provide a reference.

SOP Title	Approval Date	Pollutant(s)	Status
See Table 11-1 in QAPP	Click or tap to enter a date.	Click or tap here to enter text.	Choose an item.

d. Corrective Action

Complete the following table.

Question	Response
Does the agency have an operational, documented, and comprehensive corrective action program in place?	Yes
• As a part of the QAPP?	Yes
• As a separate document, or part of a SOP?	Yes
Does the agency have established and documented corrective action limits for QA and QC activities?	Yes
Are corrective action procedures based on results of the following that have exceeded established limits?	Click or tap here to enter text.
• 1-Point QC checks	Yes
• Calibrations and zero/span checks	Yes
• Flow rate verifications	Yes
• PEs (gaseous audits and semi-annual flow rate audits)	Yes
• Precision goals (collocated $PM_{2.5}$ and PM_{10})	Yes
• Bias goals	Yes
• NPAP audits	Yes
• PEP audits	Yes
• Completeness goals	Yes
• Data audits	Yes
• Technical Systems Audits	Yes
How is responsibility for implementing corrective actions assigned?	Site operator will be responsible to take corrective action.
How does the agency follow up on implemented corrective actions?	Zero-span calibration and multipoint check
Briefly describe at least two recent examples of the ways in which the above corrective action system was employed to remove problems.	
1. Ozone Analyzer 400E at NCore site had very low flow on 4/15/2019 because its pump is broken. Rebuild the pump and the analyzer became normal. A multipoint check is done after troubleshooting.	
2. R&P 2025 PM sampler leak check failed at NCore on 4/17/2019. Replace the V-seal and the problem solved. A flow check and a leak check are conducted to make sure that the corrective action is good and the sampler is working normally.	

e. Quality Improvement

Complete the following table.

Question	Response
Have all deficiencies indicated in the previous TSA report been corrected? If no, please list and explain.	Yes
What actions were taken to improve the quality system since the last TSA?	1. Updated QAPP 2. Cross-training of site operators 3. Develop complete quality control check forms, flow verification forms and check criteria 4. Improve documentation
Since the last TSA, do your control charts and/or AQS reports indicate that the overall data quality for each pollutant is steady or improving?	Yes
What was/were the cause(s) when goals for measurement uncertainty per 40 CFR Part 58, Appendix A were not met (if applicable)?	Click or tap here to enter text.
What are your agency's plans for quality improvement?	Complete all SOPs

f. External Performance Audits

Complete the following table.

Question	Response	Comment
Does your agency participate in the following external performance audits? If not, please explain why.		Click or tap here to enter text.
• NPAP	Yes	Click or tap here to enter text.
• $PM_{2.5}$-PEP	Yes	Click or tap here to enter text.
• Pb-PEP	No	No longer measuring for lead
• Pb Strip Audit	No	No longer measuring for lead
• Ambient Air Protocol Gas Verification Program (AA_PGVP)	No	Click or tap here to enter text.
• Round Robin metal PT	No	Click or tap here to enter text.
• NATTS/PAMS PT	No	Click or tap here to enter text.
List other performance audit participation.		Click or tap here to enter text.
Who performs NPAP and PEP audits?		Alion Laboratories

3. Network Management

This section of the questionnaire completed by: Yong Cai / Judy Low

Key Individual(s):

Title/Position	Name
Supervisor	Judy Low

a. Network Design

*For monitoring organizations and agencies that **do not submit the annual network plan (ANP)** required by 40 CFR 58.10, please complete the table below. For those monitoring organizations that **do submit an ANP**, proceed to section b. Siting.*

Site Name	AQS Site ID #	Pollutant(s) Monitored	Proposed Changes

b. Siting

b.1 Site Evaluations

Complete the following table.

Question	Yes	No	Comment
How often are site evaluations for 40 CFR Part 58, Appendix E criteria conducted?	Frequency:		**Annually**
	Date of last review:		**4/30/2019**
	Where is this documented?		**814 Jefferson Ave., R438**
Are there any siting issues?	☐	☒	Click or tap here to enter text.
Does the current level of monitoring effort (station placement, instrumentation, etc.) meet requirements imposed by current grant conditions?	☒	☐	**Continue to reserve funds for spare instrumentation**

b.2 Site Non-Conformance

Please list any monitors with siting non-conformances, the AQS Site ID numbers for those monitors, the type of non-conformance and the reason(s) for the non-conformance. If none of your agency's monitors have siting non-conformances, proceed to section c. Waivers.

Monitor	AQS Site ID #	Type of Non-Conformance	Reason(s) for Non-Conformance
Choose an item.	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.

c. Waivers

c.1 Waiver Questions

Complete the following table.

Question	Yes	No	Comment
Does your agency have any waivers?	☐	☒	Click or tap here to enter text.
Does your agency plan to request any waivers?	☐	☒	Click or tap here to enter text.
Has your agency obtained necessary waiver provisions to operate equipment which does not meet the effective reference and equivalency requirements (if applicable)?			**na**
Do any sites vary from the required operating schedules in 40 CFR 58.12?	☐	☒	Click or tap here to enter text.
Does the number of collocated monitoring stations meet the requirements of 40 CFR Part 58, Appendix A? If no, which pollutant(s)?	☒	☐	Click or tap here to enter text.

c.2 Waiver Types

Indicate any waivers requested or granted by the EPA Regional Office, and provide waiver documentation. If your agency does not have any waivers, proceed to section d. Documentation.

Waiver Type	Reason
Choose an item.	Click or tap here to enter text.

d. Documentation

Complete the following table.

Question	Yes	No	Comment
Are hard copy or electronic site information files retained by the agency for all air monitoring stations within the network? If so, please provide the location of these files in the comment field.	☒	☐	**814 Jefferson Ave., Room 438R; Memphis TN**
Does each station have the required information, including:			
• AQS Site ID Number?	☒	☐	Click or tap here to enter text.
• Photographs of the four cardinal compass points?	☒	☐	Click or tap here to enter text.
• Startup and shutdown (if applicable) dates?	☒	☐	Click or tap here to enter text.
• Documentation of instrumentation?	☒	☐	Click or tap here to enter text.
Who has custody of the current network documents?	**Name:** Judy Low **Title:** Supervisor		Click or tap here to enter text.

4. Field Operations

This section of the questionnaire completed by: Yong Cai / Judy Low

Key Individual(s) (e.g., Field Manager, Field Supervisor, Field QA Manager, etc.):

Title/Position	Name
Supervisor	Judy Low
Lead Technical Specialist	Yong Cai
Technical Specialist	Joe Maness
Technical Specialist	Betty Brown

a. Field Support

Complete the following table.

Question	Yes	No	Comment
On average, how often are most of your stations visited by a field operator?			Weekly
Is this visit frequency consistent for all reporting organizations within your agency (if applicable)?			Yes
On average, how many stations does a single operator have responsibility for?			2
How many of the stations of your SLAMS/NCORE network are equipped with sampling manifolds?			none
Do the sample inlets and manifolds meet the requirements for through-the-probe audits?	☒	☐	Click or tap here to enter text.
• Briefly describe the most common manifold type and flow rate.			Sample inlet
• How often are manifolds cleaned?			Sample inlets are checked monthly; probe lines replaced yearly or as needed
• What is used to perform the cleaning?			replaced
• Are manifolds equipped with a blower?			N/A
• Is there sufficient air flow through the manifold at all times?			N/A
• How is the air flow through the manifold monitored?			N/A
• Is there a conditioning period for the manifold cleaning?			N/A
• What is the residence time?			N/A
• How often is the residence time calculated?			N/A
Sampling lines: 1) What material is used for instrument sampling lines?			Teflon
2) How often are sampling lines changed or cleaned?			annually

Do you utilize uninterruptable power supplies or backup power sources at your sites?	☐	☒	Click or tap here to enter text.
What instruments or devices are protected?			All site instruments

Please attach an example of recent documentation of sample residence time calculation.

The QA Handbook Volume II, 7.3. Sampling Probes and Manifolds seem to indicate that the sampling time procedures described relate to calculation with a manifold. The Shelby County Health Department Air Monitoring Branch does not use manifolds at the 5 monitoring stations.

b. Instrument Acceptance

b.1 Instrumentation

Please list the instruments in your inventory.

Pollutant	Number of Instruments	Make and Models	Reference or Equivalent Number
O3	3	Teledyne Advanced Pollution Instrumentation, T400/400E	EQOA-0992-087
Trace level SO2	1	Teledyne Advanced Pollution Instrumentation, 100EU	EQSA-0495-100
Trace level CO	2	Teledyne Advanced Pollution Instrumentation, T300U/300EU	RFCA-1093-593
Trace level NO/NOy	1	Teledyne Advanced Pollution Instrumentation, T200U	RFNA-1194-699
Trace level NO2/NOx	1	Teledyne Advanced Pollution Instrumentation, T200U	RFNA-1194-599
PM10/PM2.5	6	Thermo Environmental Instruments, 2025/2025i	RFPS-0498-118
Continuous PM 10	1	Thermo Environmental Instruments, TEOM 1405	EQPM-1090-079
Continuous PM2.5	1	Thermo Environmental Instruments, TEOM 1400	-711
Continuous PM2.5	1	Teledyne Advanced Pollution Instrumentation, T640	EQPM-0516-236
Speciation	1	Met One	
Carbon	1	URG	
Wind speed/direction	2	MetOne, 50.5	
Relative humidity	2		
Pressure gauge	2		
Calibrator	5	Teledyne Advanced Pollution Instrumentation, T703/T700U/700E	
Datalogger	8	Agilaire LLC	

b.2 Instrument Needs

Please list your instrument needs in order of priority.

Instrument	Quantity	Manufacture
T640X	2	Teledyne Advanced Pollution Instrumentation
T400	1	Teledyne Advanced Pollution Instrumentation
T200U	1	Teledyne Advanced Pollution Instrumentation
T200	1	Teledyne Advanced Pollution Instrumentation
100EU	1	Teledyne Advanced Pollution Instrumentation
701H	2	Teledyne Advanced Pollution Instrumentation
T703	2	Teledyne Advanced Pollution Instrumentation
T700	1	Teledyne Advanced Pollution Instrumentation, INC.

T700U	1	Teledyne Advanced Pollution Instrumentation, INC.

c. Calibration

c.1 Calibration Frequency and Methods

Please indicate the frequency and method of multi-point calibrations of gaseous monitors.

Pollutant	Frequency	Calibration Method: Back of Instrument	Calibration Method: Through-the-Probe
O3	Quarterly	☐	☒
SO2	Quarterly	☒	☐
NO2	Quarterly	☐	☒
CO	Quarterly	☒	☒

c.2 Calibration Questions

Please complete the following table.

Question	Yes	No	Comment
How are field calibration procedures documented, and how are the results recorded?			The calibration procedures and results are recorded in both logbooks and quality control check forms
Are calibrations performed according to the guidance in Volume II of the *QA Handbook*?	☒	☐	Click or tap here to enter text.
Are calibration procedures consistent with the operational requirements of Appendices to 40 CFR Part 50 or to analyzer operation/instruction manuals?	☒	☐	**If no, why not?** Click or tap here to enter text.
Have changes been made to calibration methods based on manufacturer's suggestions for a particular instrument?	☒	☐	**If yes, what change(s)?** Click or tap here to enter text.
Do standards used for calibrations meet the requirements of appendices to 40 CFR Part 50 (EPA reference methods) and Appendix A to 40 CFR Part 58 (traceability of materials to NIST, SRMs or CRMs)?	☒	☐	**Comment on deviations.** Click or tap here to enter text.
Are all flow-measurement devices NIST-traceable?	☒	☐	Click or tap here to enter text.

d. Certification

d.1 Flow Devices

Please list the authoritative standards used for each type of flow measurement, and indicate the certification frequency of standards to maintain field material/device credibility.

Flow Device	Serial Number	Primary Standard	Certification Frequency	Use (calibration, audit, or spare)
DeltaCal	163	Click or tap here to enter text.	Annually	Calibration
TetraCal	166080	Click or tap here to enter text.	Annually	Calibration
Streamline	H060503	Click or tap here to enter text.	Annually	Calibration
BIOS	135915	Click or tap here to enter text.	Annually	Calibration
BIOS	135735	Click or tap here to enter text.	Annually	Calibration
DeltaCal	577	Click or tap here to enter text.	Annually	Calibration
TetraCal	17	Click or tap here to enter text.	Annually	Calibration
Hi Vol Flow meter	0016		Annually	Audit
TetraCal	140659		Annually	Audit

d.2 Certification Questions

Please complete the following table.

Question	Yes	No	Comment
How are certifications performed? (internally, by a vendor, or third party?)			Internally or by a vendor
Where do field operations personnel obtain gas standards?			Certified by gas manufacturer (i.e. Air Gas or registered and approved Shelby County vendor)
How are the gas standards verified after receipt?			Test through the certified instruments
What equipment is used to perform calibrations (e.g., dilution devices)?			Dilution Calibrators, Flow devices
Do the dilution air flow control and measurement devices conform to CFR requirements?	☒	☐	Click or tap here to enter text.
What traceability is used?			NIST
Is calibration equipment maintained at each station?	☐	☒	They are maintained in lab
How is the functional integrity of this equipment documented?			The certificates are kept in lab in a three ring binder and the certification results are recorded in the site logbook.

Who has responsibility for maintaining field calibration standards?	Site operators

Please have copies of certifications of all standards currently in use from your master and/or satellite certification logbooks (i.e., chemical, gas, flow, and zero air standards) available for review during the on-site TSA.

Please attach an example of recent documentation of traceability.

Mesa Labs 10 Park Place Butler, NJ 07405
NIST Traceable Calibration Facility, ISO 9001:2008 Registered

MesaLabs

CERTIFICATE OF CALIBRATION - NIST TRACEABILITY
(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: **163** DATE: 7-Mar-2019

Calibration Operator: E. Albujar

Critical Venturi Flow Meter: Max Uncertainity = 0.346%
Serial Number: 1 *CEESI NVLAP NIST Data File 04BGI151*
Serial Number: 2 *CEESI NVLAP NIST Data File 04BGI152*
Serial Number: 3 *CEESI NVLAP NIST Data File 04BGI153*
Serial Number: 4 *CEESI NVLAP NIST Data File 02BGI004*

Room Temperature: +- 0.03°C from -5°C - 70°C Room Temperature: 23.9 °C
Brand: Telatemp Serial Number: 358654
Std Cal Date 30-Oct-18 Std Cal Due Date 30-Oct-19
deltaCal:
Ambient Temperature (set): 23.9 °C
Aux (filter) Temperature (set): 23.9 °C

Barometric Pressure and Absolute Pressure
Vaisala Model PTB330(50-1100) Digital Accuracy: 0.03371%
Serial Number C4310002
Std Cal Date 26-Mar-18 Std Cal Due Date 26-Mar-19
deltaCal:
Barometric pressure (set): 756 mm of Hg

Results of Venturi Calibration
Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP= Cm of H2O

Q= 4.14463 ΔP ^ 0.53248 Overall Uncertainty: 0.35%
Q= 4.21936 ΔP ^ 0.52029 Overall Uncertainty: 0.35%

Date Placed In Service_____
(To be filled in by operator upon receipt)
Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: March 2016
Cal102-01T1 Rev D

d.3 Calibrator Certification

Please list the authoritative standards and frequency of each type of dilution, permeation and ozone calibrator, and indicate certification frequency.

Calibrator	Primary Standard	Frequency of Certification/Calibration
O3 Level 2 Standard	Click or tap here to enter text.	Annually
O3 Level 3 Standard	Click or tap here to enter text.	Quarterly
Dilution calibrator air and gas flow controllers	Click or tap here to enter text.	Quarterly

e. Repair

Complete the following table.

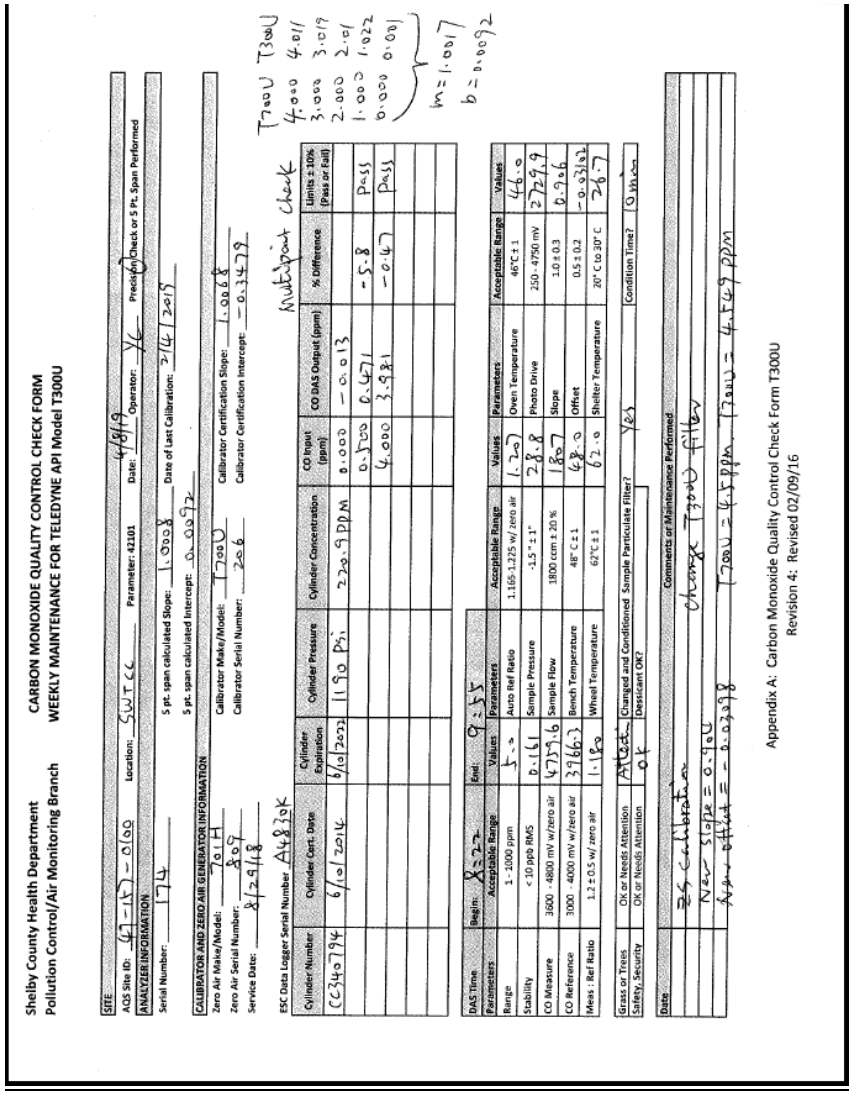
Question	Yes	No	Comment
Who is responsible for performing preventive maintenance?			Site operator
Is special training provided to those personnel who perform preventive maintenance? Briefly comment on background or courses.	☒	☐	Trained by experienced technician following manufacturer's manuals and SOPs.
What is the preventive maintenance schedule for each type of field instrumentation? If this information is provided in agency SOPs, please indicate that in the Comment section.			Routine to clean or replace parts of instrument to prevent malfunction. The schedule is provided in each instrument SOP.
If preventive maintenance is MINOR, it is performed at: (check one or more) ☒Field Station ☒Headquarters Facilities ☐Manufacturer			Click or tap here to enter text.
If preventive maintenance is MAJOR, it is performed at: (check one or more) ☐Field Station ☒Headquarters Facilities ☒Manufacturer			Click or tap here to enter text.
Does the agency have service contracts or agreements in place with instrument manufacturers? Indicate in the Comment section or attach additional pages to show which instrumentation is covered.	☐	☒	Warranty service
Comment briefly on the adequacy and availability of the supply of spare parts, tools, and manuals available to the field operator to perform any necessary maintenance activities. Do you feel that this is adequate to prevent any significant data loss?	☒	☐	Each site operator is equipped with a special tool box and necessary parts. Manuals and certificates always go with instruments. Supervisor routinely check the results to find any need of maintenance activities. Yes, it is adequate.
Is the agency currently experiencing any recurring problem with equipment or manufacturer(s)? If so, please identify the equipment or manufacturer, and comment on steps taken to remedy the problem.	☒	☐	Wind Speed and Wind Direction Sensor from MetOne Inc., replace with another one.

f. Record Keeping

Complete the following table.

Question	Yes	No	Comment
What type of station logbooks are maintained at each monitoring station? (e.g., maintenance logs, calibration logs, personal logs, etc.)			Each instrument has a bound paginated logbook to record any activity of this instrument.
• If hard-bound logbooks are used, are they electronically scanned on any routine frequency? If yes, at what frequency?	☒	☐	Site operators bring the logbooks back to the office monthly and copy the previous month's logbook entries. These copies are given to the Section Supervisor. These copies are then collected with the quality control check forms and graphs from the month by the Supervisor. These documents are used for the quality assurance process. Once the data has been submitted into AQS, all reports are scanned and saved in an electronic format for future reference.
What information is included in the station logbooks?			All operation procedures and activities related to this instrument and environment.
Who reviews and verifies the logbooks for adequacy of station performance? Does the reviewer initial or sign the logbooks to document the review?			Judy Low/Yong Cai
How is control of logbooks maintained?			They are kept at site (current) and lab (complete).
Where is the completed logbook archived?			The completed logbooks are kept in the lab
What other records are used? (Use drop-down menu below). Comment on the use and storage of these documents.			
Zero span record			Click or tap here to enter text.
Maintenance log			
Log of precision checks			
A record of audits			
Are calibration records (or calibration constants) available to field operators?	☒	☐	Click or tap here to enter text.

Please attach an example field calibration record sheet.



Shelby County Health Department
Pollution Control/Air Monitoring Branch

CARBON MONOXIDE QUALITY CONTROL CHECK FORM
WEEKLY MAINTENANCE FOR TELEDYNE API Model T300U

SITE
AQS Site ID: 47-157-0100 Location: SWTCC Parameter: 42101 Date: 4/8/19 Operator: YK Precision Check or 5 Pt. Span Performed

ANALYZER INFORMATION
Serial Number: 174 5 pt. span calculated Slope: 1.0008 Date of Last Calibration: 3/4/2015
5 pt. span calculated Intercept: 0.0092

CALIBRATOR AND ZERO AIR GENERATOR INFORMATION
Zero Air Make/Model: 701H Calibrator Make/Model: T700U Calibrator Certification Slope: 1.0068
Zero Air Serial Number: 807 Calibrator Serial Number: 206 Calibrator Certification Intercept: -0.1478
Service Date: 8/29/18

ESC Data Logger Serial Number A48198K

Cylinder Number	Cylinder Cert. Date	Cylinder Expiration	Cylinder Pressure	Cylinder Concentration	CO Input (ppm)	CO DAS Output (ppm)	% Difference	Limits ± 10% (Pass or Fail)
CC340794	6/10/2014	6/10/2022	1190 Psi	229.9 PPM	0.000	-0.013		
					0.350	0.471	-5.8	Pass
					4.000	3.981	-0.47	Pass

T700U T300U
4.011 4.000
3.019 3.000
2.011 2.000
1.022 1.000
0.011 0.000

m = 1.0017
b = 0.0092

Multipoint check

DAS Time Begin: 8:22 End: 9:55

Parameters	Acceptable Range	Values	Parameters	Acceptable Range	Values	Parameters	Acceptable Range	Values
Range	1 - 1000 ppm	1.0	Auto Ref Ratio	1.165-1.225 w/ zero air	1.207	Oven Temperature	46°C ± 1	46.0
Stability	< 10 ppb RMS	0.161	Sample Pressure	~15" ± 1"	28.8	Photo Drive	250 - 4750 mV	2724.9
CO Measure	3600 - 4800 mV w/zero air	4734.6	Sample Flow	1800 ccm ± 20 %	1807	Slope	1.0 ± 0.3	0.966
CO Reference	3000 - 4000 mV w/zero air	3786.3	Bench Temperature	48° C ± 1	48.0	Offset	0.5 ± 0.2	-0.3382
Meas : Ref Ratio	1.2 ± 0.5 w/ zero air	1.18	Wheel Temperature	62°C ± 1	62.0	Shelter Temperature	20° C to 30° C	26.7

Grass or Trees	Ok or Needs Attention	Attd	Changed and Conditioned Sample Particulate Filter?	Yes	Condition Time? 0 min
Safety, Security	Ok or Needs Attention	Ok	Desiccant OK?		

Date	Comments or Maintenance Performed
	25 calibration
	Changed T300U filter
	New Slope = 0.960
	New Offset = -0.03398 T300U = 4.5 PPM T300U = 4.546 PPM

Appendix A: Carbon Monoxide Quality Control Check Form T300U
Revision 4: Revised 02/09/16

5. Laboratory Operations

This section of the questionnaire completed by: Yong Cai

Laboratory Name:

Shelby County Health Department Pollution Control/Air Monitoring Branch Lab

Laboratory Address:

814 Jefferson Ave., R438 Memphis TN

Key Individual(s) (e.g., Laboratory Manager, Laboratory Supervisor, Laboratory QA Manager, etc.):

Title/Position	Name
Supervisor/Lead Technical Specialist	Judy Low/Yong Cai

a. Routine Operation

a.1 Methods

In the table below, identify which of the following analyses are performed in the laboratory, and state the method used to conduct the analyses.

Pollutant	Method
Hi-Vol PM10	Click or tap here to enter text.

Please describe areas where there have been difficulties meeting the regulatory requirements for any of the above methods.

The SCHD AMB does not currently utilize a laboratory for filter analysis. High volume sampling discontinued at the end of 2016. Samples are continued via a continuous analyzer and low volume FRM samplers. The PM filters are shipped to IML for filter analysis.

a.2 Quality System

Complete the following table.

Question	Yes	No	Comment
Are procedures for the methods listed in Section a.1 included in the agency's QAPP and/or SOPs?	☐	☒	Click or tap here to enter text.
Have the laboratory SOPs been reviewed and approved by EPA?	☐	☒	Click or tap here to enter text.
Are SOPs easily and readily accessible for use and reference within the laboratory? If not, where are the documents stored?	☐	☐	N/A
Does the lab have sufficient instrumentation to conduct the analyses?	☒	☐	Click or tap here to enter text.
Are separate facilities maintained for weighing the different sample types? (e.g., hi-volume vs low-volume), or is one weighing room utilized for all samples? Describe.	☒	☐	Click or tap here to enter text.
Does your laboratory hold certifications? (EPA, NIST, State, NLAC, or other)	☒	☐	Click or tap here to enter text.
Does your laboratory operate under a QA Manual or equivalent document?	☐	☐	Click or tap here to enter text.
Does your laboratory participate in PE programs?	☐	☐	Click or tap here to enter text.
Does your laboratory have a corrective action process for non-conforming work?	☐	☐	Click or tap here to enter text.
Does your laboratory have a laboratory staff person assigned the role of QA Officer?	☐	☐	Click or tap here to enter text.

Please describe needs for laboratory instrumentation.

Click or tap here to enter text.

b. Laboratory QC

b.1 Standards

Please identify the equipment and standards used in support of the gravimetric laboratory, including any quality assurance standards (such as additional weight sets or portable RH/temperature probes).

Device	Pollutant	Brand (Make)	Model (Class)	Calibration/Certification Expiration Date
Balance	Hi-Vol PM10	Rite-Weight Inc.	Sartorious	8/31/2019
Working weights	Hi-Vol PM10	Troemner LLC	A125	2/20/2019
RH/Temp Logger	Hi-Vol PM10	Microlog Pro II	EC850	11/13/2019

Please have calibration/certification records for all laboratory standards available for review during the on-site TSA.

b.2 Laboratory Temperature and RH

Complete the following table.

Question	Yes	No	Comment
What is the accuracy specification and recording time (e.g., 5 min. averaging time) of the temperature sensor (logger) used in the gravimetric laboratory?			Temperature accuracy is ±0.3°C. Recording time is 1 minute.
What is the accuracy specification and recording time (e.g., 5 min. averaging time) of the relative humidity (RH) sensor (logger) used in the gravimetric laboratory?			Relative humidity accuracy is ±2%. Recording time is 1 minute.
What is the accuracy specification for any RH/temperature audit device used in the laboratory, if applicable?			Click or tap here to enter text.
Does the laboratory utilize an infrared (IR) gun to obtain sample shipment temperatures?	☐	☒	Click or tap here to enter text.
• If yes, is the IR gun NIST-traceable? Provide the certification expiration date.	☐	☐	Click or tap here to enter text.
• If no, what device is used to obtain shipment temperature? Please describe its traceability and provide a certification expiration date.			Click or tap here to enter text.

c. Laboratory Preventive Maintenance

Complete the following table.

Question	Yes	No	Comment
For laboratory equipment, who has the responsibility for performing preventive maintenance?			Yong Cai
If equipment maintenance is performed by laboratory staff, does a SOP detail the procedures to be followed? Provide the SOP title, date, and revision number where the procedures are found.	☐	☒	Click or tap here to enter text.
Is a maintenance log maintained for the balance?	☒	☐	Click or tap here to enter text.
Are service contracts in place for the balance?	☒	☐	Click or tap here to enter text.
If utilizing a weighing room, are service contracts in place for the climate control unit/HVAC?	☐	☒	Click or tap here to enter text.
Describe static control equipment utilized in the weighing room, if applicable.			Click or tap here to enter text.
Does the weighing room undergo routine cleaning activities? On what frequency?	☐	☒	Click or tap here to enter text.
Briefly describe the weighing room cleaning regime.			Click or tap here to enter text.

d. Laboratory Record Keeping

Complete the following table.

Question	Yes	No	Comment
Are all samples that are received by the laboratory logged in?	☒	☐	Click or tap here to enter text.
Discuss sample routing (or reference the latest SOP which covers this). Attach a flow chart on the next page, if possible.			Click or tap here to enter text.
For the following four questions, select the medium used to document various activities enlisted. If the medium is not listed, select "Other" and list the medium. If the information is not recorded, select "N/A".			
• Environmental conditions, weighing session results, balance checks, and weight checks?			Handwritten ledger logbook
• Serial numbers of filters prepared for the field?			Handwritten ledger logbook
• Serial numbers of filters returning from the field for analysis?			Handwritten ledger logbook
• General information about daily lab activities, preventive maintenance procedures, and/or other significant events in the laboratory that may impact data quality or the data record?			Handwritten ledger logbook
How are data records from the laboratory archived?			The logbooks are kept in the lab.
• Where are these records archived?			814 Jefferson Ave., R438, Memphis
• Who has this responsibility? (identify person/position)			Judy Low/Supervisor
How long are these records kept? Indicate the number of months/years.			5 years
Does the laboratory SOP contain procedures for sample chain-of-custody (COC)?	☐	☒	Click or tap here to enter text.
• If yes, indicate the title, date, and revision number, and where it can be found.			Click or tap here to enter text.
What type of COC record accompanies the samples?			Hardcopy forms
Does the laboratory maintain original COCs or copies?	☒	☐	Click or tap here to enter text.
Where are COCs filed?			814 Jefferson Ave., R438, Memphis

If possible, attach a sample routing flow chart:

e. Laboratory Data Acquisition and Handling

Complete the following table.

Question	Yes	No	Comment
Identify those laboratory instruments (e.g., balances, temperature/RH loggers, etc.) which make use of computer interfaces directly to record data.			RH/Temp Datalogger
Are QC data results readily available to the analyst during a weigh session?	☒	☐	Click or tap here to enter text.
Do RH/temperature loggers record values using paper chart records (chart wheels)? If yes, where are the paper charts maintained? Are they signed and dated?	☐	☒	Click or tap here to enter text.
What is the laboratory's capability with regards to data recovery? In case of problems, can the laboratory recapture data that may be lost in the event of computer failure? Discuss briefly.			N/A
Does the laboratory maintain an SOP that discusses how to use the laboratory's data acquisition instrumentation? If yes, please provide the SOP title, date, and revision number.	☐	☒	Click or tap here to enter text.

Please attach a flow chart/diagram which illustrates the transcriptions, verifications, validations, and reporting processes the data goes through before being released by the laboratory.

f. Filter Questions

Complete the following table.

Question	Yes	No	Comment
Does the agency use filters supplied by EPA?	☒	☐	Click or tap here to enter text.
• If no, do the filters utilized meet the specifications in 40 CFR Part 50? Who is the vendor? Be prepared to provide documentation to demonstrate acceptance testing results.	☐	☐	Click or tap here to enter text.
Are unexposed filters equilibrated in a controlled conditioning environment which meets or exceeds the requirements of 40 CFR Part 50? Describe the conditioning room/chamber.	☒	☐	A Dricycler chamber made by Boekel Scientific is used to control the filter environment.
How long is the conditioning period?			More than 24 hours
Briefly describe how exposed filters are prepared for conditioning.			Put the exposed filter in the conditioning chamber for more than 24 hours before weighing.
Briefly describe how and where exposed filters are stored after being weighed.			The filter are stored in the original box after being weighed and kept in lab.
On what frequency are lab blanks utilized?			Two weeks
Are chemical analyses performed on filters? If yes, which? Where are these additional analyses performed?	☐	☒	Click or tap here to enter text.

g. Metals & Other Analyses

If your laboratory completes lead (Pb) and/or other metals analyses, please complete the tables in this section.

g.1 Laboratory QA/QC

Question	Yes	No	Comment
Are at least one duplicate, one blank, and one standard or spike included with a given analytical batch?	☐	☐	Click or tap here to enter text.
Briefly describe the laboratory's use of data derived from blank analyses.			Click or tap here to enter text.
Are criteria established to determine whether blank data are acceptable?	☐	☐	Click or tap here to enter text.
How frequently and at what concentration ranges does the lab perform duplicate analyses? What constitutes an acceptable agreement?			Click or tap here to enter text.
Please describe how the lab uses data obtained from spiked samples, including the acceptance criteria (e.g., acceptable percent recovery).			Click or tap here to enter text.
Does the laboratory include samples of reference material within an analytical batch? If yes, indicate the frequency, level, and material used.	☐	☐	Click or tap here to enter text.
Are mid-range standards included in analytical batches? If yes, describe the frequency, level, and compound.	☐	☐	Click or tap here to enter text.
Are criteria for real-time QC established that are based on the results obtained for the mid-range standards discussed above? If yes, briefly discuss them below or indicate the document in which they can be found.	☐	☐	Click or tap here to enter text.
Are appropriate acceptance criteria for each type of analysis documented?	☐	☐	Click or tap here to enter text.

g.2 Chemicals

Question	Yes	No	Comment
Are all chemicals and solutions clearly marked with an indication of shelf life?	☐	☐	Click or tap here to enter text.
Are chemicals removed and properly disposed of when the shelf life expires?	☐	☐	Click or tap here to enter text.
Does the laboratory purchase standard solutions, such as those for use with Pb or other metals analyses?	☐	☐	Click or tap here to enter text.
Are only ACS grade chemicals used by the laboratory?	☐	☐	Click or tap here to enter text.
Comment on the traceability of chemicals used in the preparation of calibration standards.			Click or tap here to enter text.

g.3 Pb

Question	Response	Comments
Is Pb analysis performed by a contract laboratory? If yes, provide the laboratory name in the comment section.	Choose an item.	Click or tap here to enter text.
What filter media is used for Pb analysis?	Choose an item.	Click or tap here to enter text.
Are filter samples visually inspected for defects (e.g., pinholes, tears and non-uniform deposit)?	Choose an item.	Click or tap here to enter text.
Are filters invalidated if defects are found? If no, why not?	Choose an item.	Click or tap here to enter text.
Are tweezers used to handle filters? If yes, what material are the tweezers made of (e.g., Teflon, plastic, metal, etc.)?	Choose an item.	Click or tap here to enter text.
What extraction method is used for filters?	Choose an item.	Click or tap here to enter text.
What reagents are used to clean glassware?		Click or tap here to enter text.
List standards used for analysis.		Click or tap here to enter text.
Are filter lot blanks analyzed for Pb content at a rate of 20 to 30 random filters per batch of 500 or greater? ***Only for filters not provided by EPA.***	Choose an item.	Click or tap here to enter text.
How often are MDLs determined?		Click or tap here to enter text.
How many replicates are used for MDLs?		Click or tap here to enter text.
Are MDLs calculated in accordance with 40 CFR Part 136, Appendix B? If not, why not?	Choose an item.	Click or tap here to enter text.
Are waste HNO_3, HCL, and solutions containing these reagents and/or Pb placed in labeled bottles and delivered to a commercial firm that specializes in removal of hazardous waste?	Choose an item.	Click or tap here to enter text.

6. Data & Data Management

This section of the questionnaire completed by: Yong Cai

Key Individual(s):

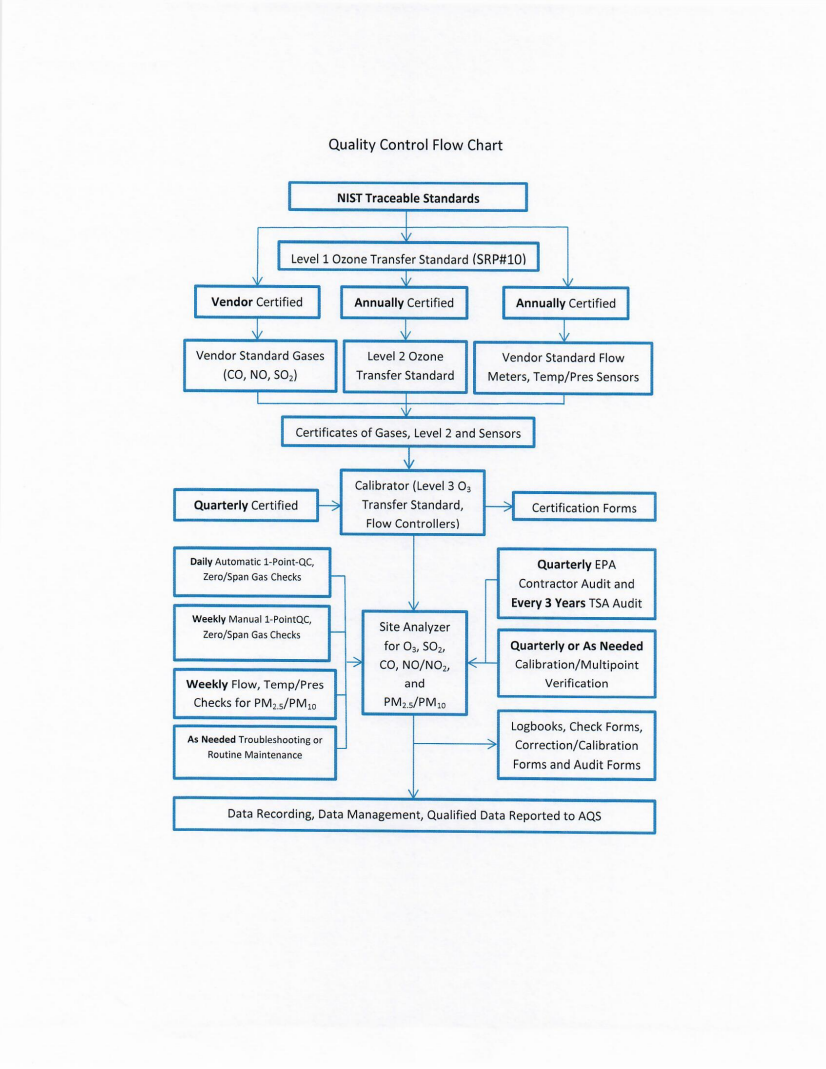
Title/Position	Name
Supervisor	Judy Low
Lead Technical Specialist	Yong Cai
Technical Specialist	Betty Brown
Technical Specialist	Joe Maness

a. Data Handling

Complete the following table.

Question	Yes	No	Comment
Is there a procedure, description, or a chart which shows a complete data sequence from point of acquisition to point of submission of data to EPA?	☒	☐	Click or tap here to enter text.
Are procedures for data handling (e.g., data reduction, review, etc.) documented? If yes, comment on where.	☒	☐	QAPP, SOP
In what media (e.g., flash drive, telemetry, wireless, etc.) and formats do data arrive at the data processing location?			Ethernet
How often are data received at the processing location from the field sites and laboratory?			Hourly
Are there any activities being done before data is released to agency internal data processing?	☒	☐	Review data and label all invalid data
How are data entered into the computer system? (e.g., computerized transcription, manual entry, digitization of strip charts, or other)?			Ethernet
For manual data, is a double-key entry system used?	☐	☐	None

Please provide a data flow diagram indicating the data flow within the reporting organization.



b. Software Documentation

Complete the following table.

Question	Yes	No	Comment
Does your agency use an AQS Manual? If yes, list the title of the manual used including the version number and date published.	☐	☒	Click or tap here to enter text.
Does your agency use an AirNow Manual? If yes, list the title of the manual used including the version number and date published.	☐	☒	Click or tap here to enter text.
Does the agency have information on the reporting of precision and accuracy data available?	☒	☐	Click or tap here to enter text.
What software is used to prepare air monitoring data for release into the AQS and AirNow databases? Include the names of the software packages, vendor or author, revision numbers, and the revision dates of the software.			AirVision 3.4.15, 7/13/2017, Agilaire LLC,
What is the recovery capability in the event of a significant computer problem (i.e., how much time and data would be lost)?			Dataloggers at sites store 7 days' minute data and 14 days' hourly data. SCHD IT back up the servers nightly.
Has your agency tested the data processing software to ensure its performance of the intended function are consistent with the *QA Handbook Volume II, Section 14.0*?	☐	☒	Click or tap here to enter text.
Does your agency document software tests? **If yes, provide the documentation.**	☐	☒	Click or tap here to enter text.

c. Data Validation and Correction

Complete the following table.

Question	Yes	No	Comment
Is there documentation in regards to data that has been identified as suspect and subsequently flagged?	☒	☐	Click or tap here to enter text.
Please describe what action the data validator will take (e.g., flags, invalidate, etc.) if they find data with exceeded QC criteria.			Depending on the issue, data will be flagged or invalidated forwarded and back to the last good check/verification.
Please describe how changes made to data that were submitted to AQS and AirNow are documented.			Documented on the monthly Air Vision report
Who has signature authority for approving corrections?			**Name:**Click or tap here to enter text. **Program Function:**Click or tap here to enter text.
What criteria are used to determine a data point be deleted or invalidated?			See QAPP or SOP for each respective pollutant
What criteria are used to determine if data need to be reprocessed?			See QAPP or SOP for each respective pollutant
Are corrected data resubmitted to the issuing group/record generator for cross-checking prior to release?	☒	☐	Click or tap here to enter text.

d. Data Processing

d.1 Reports

Complete the following table.

Question	Yes	No	Comment
Does the agency generate data summary reports?	☒	☐	Click or tap here to enter text.
Please list at least three reports routinely generated, including the information requested below.			

Report Title	Distribution	Period Covered
Daily Summary Report	**Air Monitoring Staff**	**Daily summary**
Monthly Report	**Air Monitoring Staff**	**Monthly summary**
Statistical Report	**Air Monitoring Staff**	**Monthly summary**

d.2 Data Submission

Complete the following table.

Question	Yes	No	Comment
How often are data submitted to AQS?			Quarterly by the month
How often are data submitted to AirNow?			Hourly
Briefly comment on difficulties the agency may have encountered in coding and submitting data following the AQS guidelines.			Click or tap here to enter text.
Does the agency retain a hard copy printout or an electronic copy of submitted data from AQS?	☒	☐	both
Are records kept by the agency for at least three years in an orderly, accessible form? If yes, does this include:	☒	☐	Click or tap here to enter text.
• Raw data	☒	☐	Click or tap here to enter text.
• Calculations	☒	☐	Click or tap here to enter text.
• QC data	☒	☐	Click or tap here to enter text.
• Reports: list which reports are used	☒	☐	Click or tap here to enter text.
Has your agency submitted data (along with the appropriate calibration equations used) to the processing center?	☐	☐	Click or tap here to enter text.
Are concentrations of PM_{10} corrected to EPA standard temperature and pressure conditions (i.e., 298 K, 760 mm Hg) before input to AQS?	☒	☐	Click or tap here to enter text.
Are concentrations of $PM_{2.5}$ and Pb reported to AQS under actual (volumetric) conditions?	☒	☐	Click or tap here to enter text.
Are audits on data reduction procedures performed on a routine basis? If yes, at what frequency?	☐	☐	Click or tap here to enter text.
Are precision and accuracy data checked each time they are calculated, recorded, or transcribed to ensure that incorrect values are not submitted to EPA?	☒	☐	Click or tap here to enter text.

e. Internal Reporting

e.1 Reports

What internal reports are prepared and submitted as a result of the audits required under 40 CFR Part 58, Appendix A?

See Section 21.0 of QAPP

Report Title	Frequency

What internal reports are prepared and submitted as a result of the precision checks required under 40 CFR Part 58, Appendix A?

Report Title	Frequency

Question	Yes	No	Comment
Do either the audit or precision check reports indicated include a discussion of corrective actions initiated based on audit or precision check results?	☐	☐	Click or tap here to enter text.

e.2 Responsibilities

Who has the responsibility for the calculation and preparation of data summaries? To whom are such summaries delivered?

Name	Title	Type of Report	Recipient
		Click or tap here to enter text.	

Identify the individuals within the agency responsible for reviewing and releasing the data.

Name	Program Function
	Click or tap here to enter text.

Question	Yes	No	Comment
Does your agency report to the Air Quality Index (AQI)?	☒	☒	Click or tap here to enter text.
Is data certification signed by a senior officer of your agency?	☒	☐	Click or tap here to enter text.